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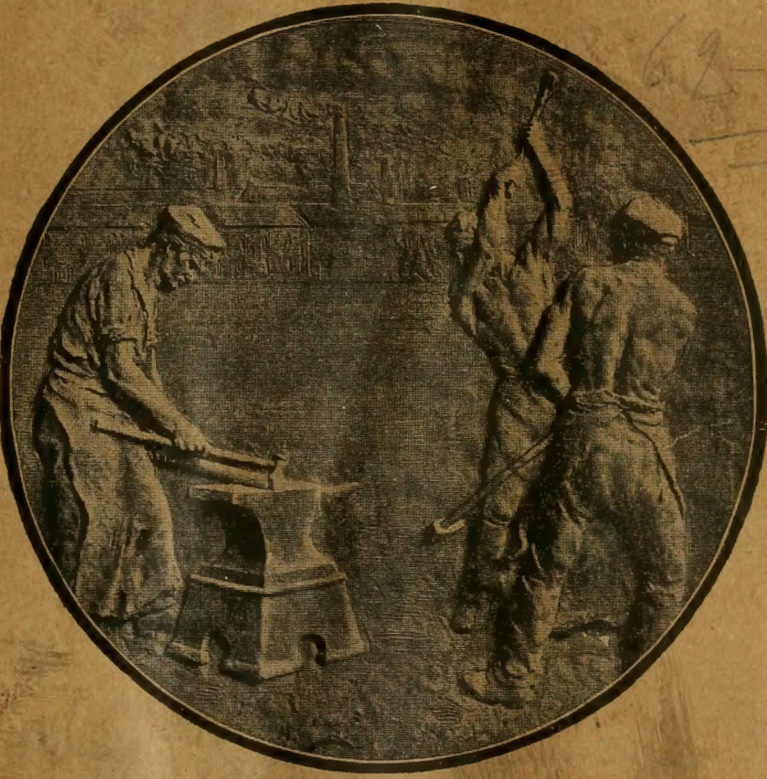
PAGE'S WEEKLY



ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

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GERMANY, Berlin : 13, Unter den Linden.
RUSSIA, St. Petersburg : 14, Nevsky Prospect.
ITALY, Rome : 307 Corso.
AUSTRIA, Vienna : Kärntnerstrasse, nr. 30.

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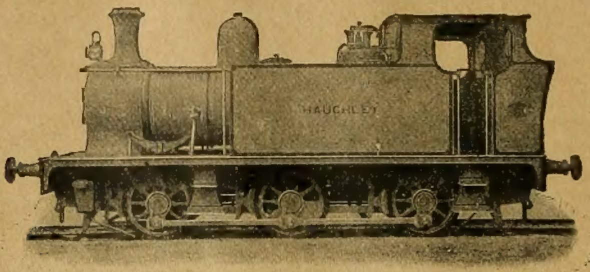
LOCOMOTIVE ENGINES,

Of all sizes and any gauge of Railway, of greatly improved Construction, for Main or Branch Railways, Contractors, Ironworks, Collieries. Prices, Photographs, and full Specifications on application.



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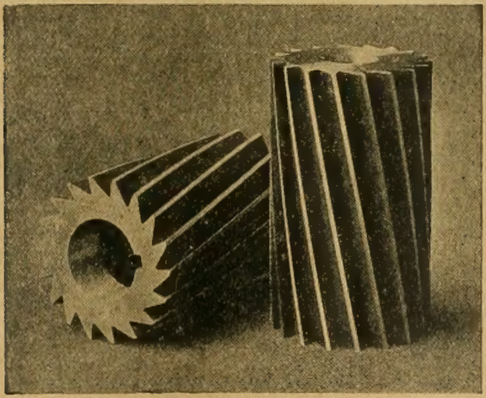

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The Sole Product of a Factory.

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PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,
Consulting and Organising Engineer for Water Works and Industrial Undertakings,
19, OLD QUEEN ST., WESTMINSTER, S.W.
Telephone No.: 5754 Bank. Write for particulars.

PATENTS.
Mr. J. G. LORRAIN, M.I.E.E., M.I.Mech.E., Fellow of the Chartered Institute of Patent Agents.
NORFOLK HOUSE, NORFOLK STREET, STRAND, LONDON, W.C.
"PATENTEES' HANDBOOK," post free on application, gives Full Information to Inventors and upon all the chief points of the Patent Law.
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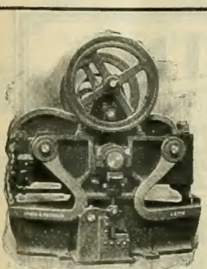

PUNCHING & SHEARING Machines.
STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.
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Leith Ironworks, EDINBURGH.

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	Size.	Working Pressure
One Thompson Boiler,	30 ft. by 8 ft. 6 in.	for 160 lb.
Three ,, ,,	30 ft. ,, 8 ft. 6 in.	,, 120 lb.
One ,, ,,	30 ft. ,, 8 ft. 6 in.	,, 100 lb.
Three ,, ,,	30 ft. ,, 8 ft.	,, 120 lb.
Six ,,	30 ft. ,, 8 ft.	,, 100 lb.
One ,, ,,	28 ft. ,, 7 ft.	,, 140 lb.
One Cornish ,,	20 ft. ,, 5 ft.	,, 100 lb.

All sizes of Vertical Boilers from 2 to 20 n.h.p.
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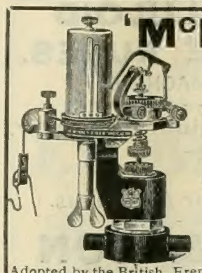
A. MOUNT-HAES,
M.I.Mech.E., M.I.M.E.,
Consulting and Mining Engineer for Ore Dressing Plants of All Classes.
11, IRONMONGER LANE, LONDON. E.C.
Tel. Address: "DRESSINGS, LONDON." Telephone No.: 272 Central.



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In Two types: External and Enclosed Pressure Springs.
Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.
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These Boilers are in use throughout the world to the extent of 4,700,000 h.p. generating steam for all purposes, and fired with all kinds of fuel.
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STANCHIONS AND GIRDERS.
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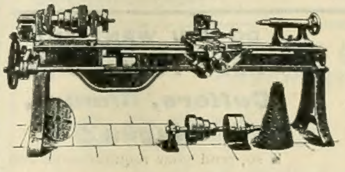

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In stock for immediate delivery.
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CONTENTS.—The Principles of Mining Law.—The Mining Law of Great Britain.—British India.—Ceylon.—Burma.—The Malay Peninsula.—British North Borneo.—Cyprus.—The Dominion of Canada.—British Guiana.—The Gold Coast Colony and Ashanti.—Cape of Good Hope.—Natal.—Orange River Colony.—Transvaal Colony.—Rhodesia.—The Commonwealth of Australia.—New Zealand, &c.—INDEX.

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THE SCIENTIFIC AND LEARNED SOCIETIES
OF GREAT BRITAIN AND IRELAND.
Contains (with other official information) List of Papers read during the Session 1904-5, before all the leading Societies throughout the Kingdom.
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PAGE'S WEEKLY Miscellaneous

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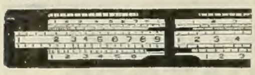

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Marks, Name Stamps, Branding Irons,
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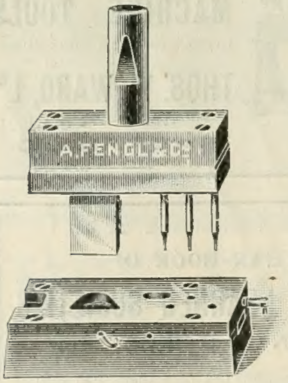
See our Advertisement appearing Jan. 19th.

TEMPERLEY TRANSPORTER CO.,
72, Bishopsgate Street Within, LONDON, E.C.
Telephone: 365 London Wall. Telegrams: "Transumo."



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FOR RAISING SEWAGE, SLUDGE, WATER, &c.

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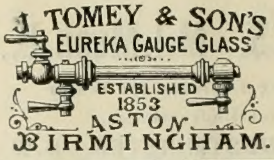

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PAGE'S WEEKLY Miscellaneous

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CLERKENWELL
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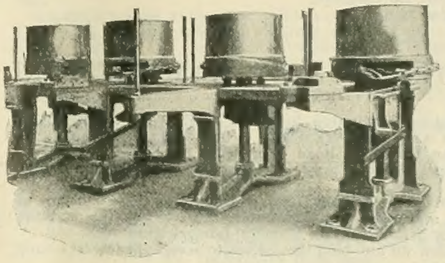

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MODERN WIRE-WORKING MACHINERY,
Wire-Weaving Power Looms, Netting Machinery, Complete Machinery for Electrical Wire, Wire Rope and Wire Testing Machinery.

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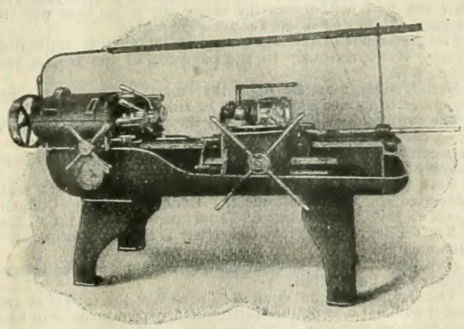
FLAT TURRET LATHE



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97, Queen Victoria Street, LONDON.

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COVENTRY, ENG.

Speciality—
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"H. G. T."
(High Grade Throughout.)
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Lists and Samples Free.

BEANLAND, PERKIN & Co.,
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PAGE'S WEEKLY Contracts

CONTRACTS.

LEYTON URBAN DISTRICT COUNCIL.

TRAMWAYS.

TO ENGINEERS.

The Electric Lighting Committee of the Leyton Urban District Council is prepared to receive **TENDERS** for the following PLANT:—

(1) 500 KILOWATT DYNAMOS.
(2) OVERHEAD CRANE.

Specifications and Forms of Tender may be obtained from the undersigned, upon a deposit of £1 1s. being made in respect of each Specification required.

Tenders, suitablv endorsed, are to be sent for opening at the meeting of the Electric Light Committee, at the Town Hall, Leyton, on January 18th, 1906.

The Council does not bind itself to accept the lowest or any Tender.

By order,
F. HARMAN LEWIS,
Electrical Engineer to the Council.

Electric Light and Power Works,
Cathall Road, Leytonstone,
December 27th, 1905.

CORPORATION OF WIMBLEDON.

TO ENGINEERS.

The Wimbledon Corporation invite **TENDERS** for the **SUPPLY** and **FIXING** of **AIR COMPRESSORS** to be electrically driven, at the Pumping Station, Durnsford Road, Wimbledon.

Plans and Specifications may be obtained on application to the undersigned.

Tenders, endorsed "Air Plant," and addressed to the Chairman of the Highways and Sewerage Committee, must be delivered at the Town Hall on or before noon on Monday, January 22nd, 1906.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
C. H. COOPER, M.I.C.E.,
Borough Engineer and Surveyor.

Town Hall, Wimbledon,
December 20th, 1905.

BOROUGH OF STRATFORD-ON-AVON.

SEWAGE DISPOSAL WORKS.

TENDERS are invited for the **MANUFACTURE, DELIVERY, and ERECTION** of **THREE SETS** of **GAS** or **OIL ENGINES** and **PUMPS.**

Specification and Drawings may be obtained at the Offices of the Engineers, Messrs. WILLCOX AND RAIKES, Union Chambers, 63, Temple Row, Birmingham, on or after January 1st, 1906, on payment of a deposit of Two Guineas, which will be refunded (after the Contract has been decided upon) to those persons who have sent in a *bona fide* Tender and who have returned the whole of the documents entrusted to them.

Sealed Tenders, upon the forms supplied, endorsed "Stratford-on-Avon Sewage Disposal Pumping Machinery," to be delivered at my office not later than 12 o'clock noon on January 22nd, 1906.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
ROBERT LUNN,
Town Clerk.

Town Clerk's Office, Stratford-on-Avon,
December 22nd, 1905.

OAKENGATES URBAN DISTRICT COUNCIL.

WATERWORKS.

TO CONTRACTORS AND IRONFOUNDERS.

The above Council is prepared to receive **TENDERS** from competent persons for the **PROVISION** and **LAYING** of **CAST IRON** and other **MAINS.**

The Drawing may be seen and copies of the Specification, Bill of Quantities, and form of Tender, may be obtained at the office of the Engineers, Messrs. R. E. W. BERRINGTON AND SON, Bank Buildings, Wolverhampton, on and after Wednesday, December 20th, upon payment of Five Guineas, which will only be returned upon the receipt of a *bona fide* Tender.

Sealed Tenders, addressed to me, endorsed "Tender for Waterworks," must be delivered at my office before noon on Saturday, January 20th, 1906.

The Council does not bind itself to accept the lowest or any Tender.

JNO. A. HOLMES, Solicitor,
Clerk to the Council.

Oakengates, December 13th, 1905.

CORPORATION OF DURBAN, NATAL.

WATERWORKS EXTENSION.

TENDERS FOR 30-in STEEL PIPES.

The Corporation of Durban, Natal, is prepared to receive **TENDERS** for the SUPPLY and DELIVERY, "free on board" (and alternately for delivery c.i.f., Durban) of six miles of 30-in. **MILD STEEL PIPES**, weighing approximately 1,500 tons. Three miles to be delivered at Durban not later than June 30th, 1906, and the remaining three miles to be delivered not later than November 30th, 1906.

General Conditions, Specification, and Bill of Quantities, with form of Tender, can be obtained from Mr. W. H. RADFORD, C.E., Albion Chambers, Nottingham, Consulting and Representative Engineer to the Corporation, on deposit of Three Guineas, which will be returned on receipt of a *bona fide* Tender.

Sealed and endorsed Tenders must be delivered to the undersigned, Agents to the Durban Corporation, on or before Monday, January 15th, 1906.

The lowest or any Tender will not necessarily be accepted.

By order,
WEPSTER, STEEL, AND CO.,
Agents to the Durban Corporation.

5, East India Avenue, Leadenhall Street, London, E.C.,
December 16th, 1905.

CITY OF LAUNCESTON, TASMANIA.

ELECTRIC LIGHT DEPARTMENT.

TENDERS FOR SUPPLY OF METERS.

The MAYOR and ALDERMEN of the City of Launceston, Tasmania, are prepared to receive **TENDERS** for the SUPPLY of 500 or more ELECTRIC METERS and for MAXIMUM DEMAND INDICATORS.

Specifications and Conditions of Contract in duplicate may be obtained on application to Mr. WILLIAM CORIN, City Electrical Engineer, Launceston, Tasmania, or to Messrs. JOHN TERRY AND CO., 7, Great Winchester Street, London, E.C., England, on payment of Two Guineas, which sum will be refunded on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Tenders for Supply of Electric Meters," must be addressed to the undersigned and lodged in his office not later than 12 o'clock noon of Monday, the 15th day of January, 1906.

C. W. ROCHER,
Town Clerk.

Town Hall, Launceston, Tasmania,
September 25th, 1905.

COUNTY OF LONDON. — TO STEEL RAIL MANUFACTURERS, ENGINEERS, AND OTHERS.

The London County Council invites **TENDERS** for the **SUPPLY** and **DELIVERY** of about 2,300 **TONS** of **STEEL SLOT RAILS** required in connection with the reconstruction, for electrical traction on the conduit system, of certain of the Council's tramways north of the Thames.

Persons desiring to submit Tenders may, on and after Monday, December 18th, 1905, obtain the Specification, Bill of Quantities, form of Tender, and other particulars, on application to the Engineer's Department, County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of £2.

This amount will, after the Council or its Committee shall have come to a decision upon the Tenders received, but not before, be returned to the Tenderer, provided he shall have sent in a *bona fide* Tender and shall not have withdrawn the same, but in no case will the fee be returned unless a *bona fide* Tender is submitted.

Full particulars of the work may be obtained on application at the County Hall previously to the payment of the fee for the Specification, &c.

Each Tender must be upon the official form, and the printed instructions contained therein must be strictly complied with.

The contractors will be bound by the contract to pay to all workmen for work executed under the contract wages at the rates arranged between the employers and workmen in the rail trade in that part of the country where the order is placed.

Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the "Clerk of the London County Council, Spring Gardens, S.W.," and marked "Tender for Slot Rails, L.C.C. Tramways."

No Tender will be received after Ten o'clock a.m. on Tuesday, January 16th, 1906.

Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.

County Hall,
Spring Gardens, S.W.,
December 15th, 1905.

PAGE'S WEEKLY Contracts and Appointments Open

CROMPTON URBAN DISTRICT COUNCIL.

The Crompton Urban District Council solicit Tenders for the following:—

(1) SLUDGE-PRESSING MACHINERY.

(2) GAS ENGINE to give 25 brake horse-power when worked with producer gas, also necessary GAS-PRODUCER PLANT for working same.

The prices in each case to include delivery and erection at Council's Newhey Sewage Works.

Further particulars may be obtained on application to Mr. T. MITCHELL, F.G.S., Sewage Works Superintendent, Shaw.

Tenders, sealed and endorsed "Sludge-pressing Machinery," or "Gas Engine and Producer," as the case may be, must be delivered to me on or before Monday, January 8th, 1906.

Town Hall, Shaw, F. F. GARTSIDE.
December 13th, 1905. Clerk to the Council.

THE SECRETARY OF STATE FOR INDIA

in Council is prepared to receive TENDERS from such persons as may be willing to supply:—

60 FEET SPANS.

The Conditions of Contract may be obtained on application to the Director-General of Stores, India Office, Whitehall, S.W., and Tenders are to be delivered at that office by Two o'clock p.m. on Tuesday, January 16th, 1906, after which time no Tender will be received.

E. GRANT BURLS,
Director-General of Stores.

India Office, Whitehall,
December 28th, 1905.

PARISH OF LAMBETH.—BOARD OF GUARDIANS.

The Guardians of the Poor of the Parish of Lambeth hereby invite TENDERS for RE-BUILDING a PAIR of HORIZONTAL ENGINES at their Renfrew Road Workhouse, including new 15 in. cylinders, pistons, connecting-rods, &c., and turning up a 10-ft fly-wheel.

Form of Tender, Specification, and Conditions will be supplied, and draft of Contract may be inspected, on written application to Mr. GEORGE E. ARNOLD, C.E., 26 Victoria Street, Westminster, S.W.

Tenders, which will be received only on the printed form, sealed and endorsed "Tender for Re-building Engines," must be sent to me, the undersigned, by post, not later than Tuesday, January 16th, 1906, and will be opened at the Board Room at noon on the following day.

The Guardians do not pledge themselves to accept the lowest or any Tender.

By order,
W. THURNALL,
Clerk.

Guardians' Board Room and Offices,
Brook Street, Kennington Road, S E.,
December 27th, 1905.

SWANSEA HARBOUR TRUST.

CONTRACT FOR WEST PIER EXTENSION.

The SWANSEA HARBOUR TRUSTEES invite TENDERS for EXTENDING seaward the EXISTING WEST PIER.

The extension to be either for 800, 1,000, 1,200, or 1,400 feet, as the Trustees may determine.

Drawings of the proposed work may be inspected at the office of the Trustees' Engineer, Mr. A. O. SCHENK, Mem.Inst.C.E., and copies of the Specification, Conditions, Schedule of Quantities, and Forms of Tender obtained of the undersigned on payment of £2 2s., which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "West Pier Extension," should be delivered to the undersigned at or before 10 a.m. on Thursday, January 18th next.

The Trustees do not bind themselves to accept the lowest or any Tender.

TALFOURD STRICK,
Clerk.

Harbour Offices Swansea,
December 22nd, 1905.

ADMINISTRATIVE COUNTY OF LONDONDERRY.

The County Council of the above-named County invite TENDERS, which must be lodged with me on or before Thursday, January 18th, 1906, for the SUPPLY and DELIVERY of:—

ONE STEAM ROAD ROLLER.
ONE ROAD SLEEPING VAN.
ONE WATER CART.

Specifications for the articles required may be seen, or copies obtained, at the office of the County Surveyor, County Courthouse, Londonderry.

Dated this 8th day of December, 1905.

THOMPSON B. ADAMS,
County Courthouse, Londonderry. Secretary to County Council

APPOINTMENTS OPEN.

CITY OF BRADFORD.—THE CORPORATION

invite APPLICATIONS for the appointment of THREE ENGINEERING ASSISTANTS in the Sewage Works, Engineer's Department, at a salary of £150 per annum each.

Candidates must have had actual experience in the designing and construction of large sewers and works of sewage disposal. Age not to exceed 35.

Applications endorsed "Engineering Assistant," stating age and experience, must be accompanied by copies of two testimonials of recent date, and addressed to me at the Town Hall, Bradford, before January 16th, 1906.

FREDERICK STEVENS,
Town Clerk.

AN "INSTITUTION OF NAVAL ARCHITECTS" SCHOLARSHIP,

of the annual value of £50, and, subject to certain conditions, tenable for three years, will be OFFERED for COMPETITION by the Council of the above Institution.

Candidates must, at the time of the examination, be students of the Institution, and not less than eighteen or more than twenty-one years of age on March 1st, 1906, and must at that date have been continuously employed for two years upon Naval Architecture or Marine Engineering.

Further particulars and forms of entry and conditions regulating the admission of students, may be obtained from the Secretary, Institution of Naval Architects, 5, Adelphi Terrace, London, W.C.

Applications must be sent in by February 1st, 1906.

CIVIL SERVICE COMMISSION.

FORTHCOMING EXAMINATION.

SECOND-CLASS ENGINEERS, ENGINEER-IN-CHIEF'S DEPARTMENT, GENERAL POST OFFICE (22-24).

JANUARY 11TH, 1906.

The date specified is the latest at which applications can be received. They must be made on forms to be obtained, with particulars, from the Secretary, Civil Service Commission, Burlington Gardens, London, W.

LONDON, BRIGHTON, AND SOUTH COAST RAILWAY COMPANY.

SIGNAL SUPERINTENDENT.

The Directors of the above Company are prepared to receive APPLICATIONS for the POST of SIGNAL SUPERINTENDENT in the Permanent Way Department of the Railway. Salary, £300 per annum.

Applications, giving full particulars of past experience, and stating age, which must not exceed 35 years, should be sent to me by post, in an envelope marked "Signal Superintendent," so as to be delivered at my office not later than 10 o'clock a.m. on Friday, January 19th, 1906.

J. J. BREWER,
Secretary.

Secretary's Office,
London Bridge Terminus, S.E.,
December 28th, 1905.

NOTICE TO MARINE ENGINEERS.

The Arklow Harbour Commissioners require the SERVICES of an ENGINEER to prepare plans for the Extension of the South Breakwater, and to superintend the carrying out of same. Such plans to meet the approval of the Harbour Commissioners and the sanction of the Lord-Lieutenant.

Parties applying for the position must satisfy the Board that their appointment will have the approval of the Lord-Lieutenant.

Applications to be sent, stating fees, &c., to the Secretary, Harbour Commissioners, before January 9th, 1906.

CARNEGIE RESEARCH SCHOLARSHIPS.

—The Council of the Iron and Steel Institute will shortly proceed to award Research Scholarships founded by Mr. Andrew Carnegie.

Candidates, who must be under 35 years of age, must apply before February 28th on special forms to be obtained from BENNETT H. BROUGH, Secretary, Iron and Steel Institute, 28, Victoria Street, London, S.W.

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FOR SALE.—STEEL SHAFT, PLATES $\frac{3}{8}$in. riveted, 100 feet high, 6 feet diameter; nearly new. Suitable for factory, mill, or temporary purposes. Bargain for quick sale.—Apply, HOOPER, NEARY & Co., Trafalgar Road, Greenwich, S.E.

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NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 22 and 24.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

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PAGE'S WEEKLY Machine Tools, &c.

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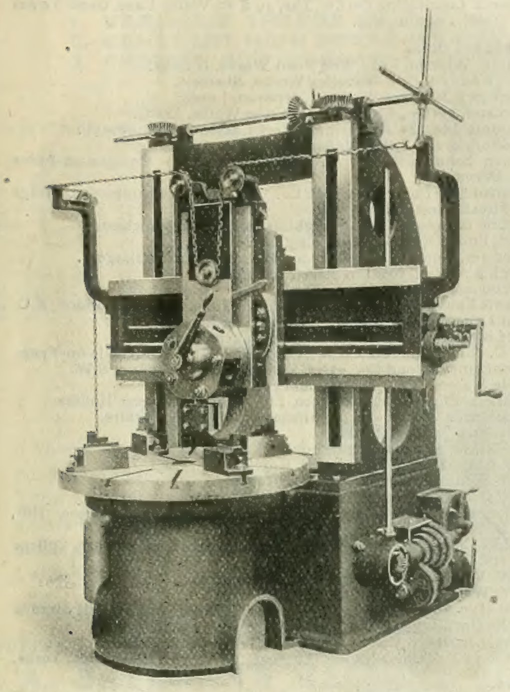

42-inch
Turning & Boring Mill

Admits in diameter	42 in.
Diameter of Circular Table	40 "
Admits in height under Cross Slide	40 "
Traverse of Turret Slide, horizontally	22 "
" " vertically	20 "
Eight changes of feed, vertically and horizontally.	
Gear Power (maximum)	24·3 to 1
5-speed Cone	20 in. to 10 in. dia.
Width of Belt	3½ in.
Slide Swivels to...	30°
Capstan Block for five tools.	
Size of holes in Turret	2¼ in.
Speed of Countershaft	120 and 70 revs.
Approximate Weight	90 cwts.

Is also made with two heads on Crossrail.

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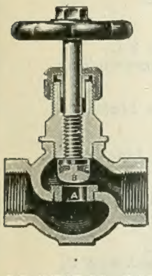

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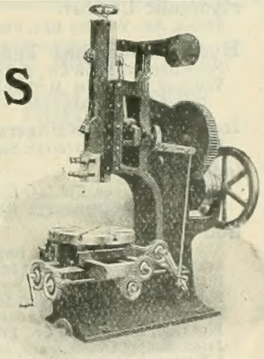

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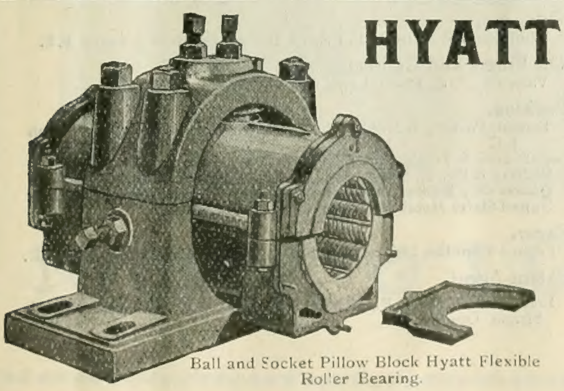

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See Conveying Machinery.

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Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

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Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
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United States Metallic Packing Co., Ltd., Bradford,

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Size of Planer	Length of stroke.		Time of 10 cycles.		Feet travelled. Stroke × 2 × 10	Average Speed. Feet per minute	Maximum Speeds. Feet per minute		Mean Speed Feet per minute.	
in. in. ft	ft.	in.	m.	sec.			cut.	retn.	cut.	retn.
24 × 24 × 6	6	3½	1	8	126	111	80	225	78	210
36 × 36 × 12	12	0	6	0	240	40	20	175	20	160
(With 3 speed gear box for cut)	12	0	3	34	240	67	40	175	40	160
	12	0	2	46	240	87	62	175	60	160
42 × 42 × 20	22	6	6	39	450	68	45	145	44½	141
42 × 42 × 14	14	0	3	56	280	71	50	155	48	147
60 × 60 × 12	13	0	4	8	260	63	42½	140	42	127

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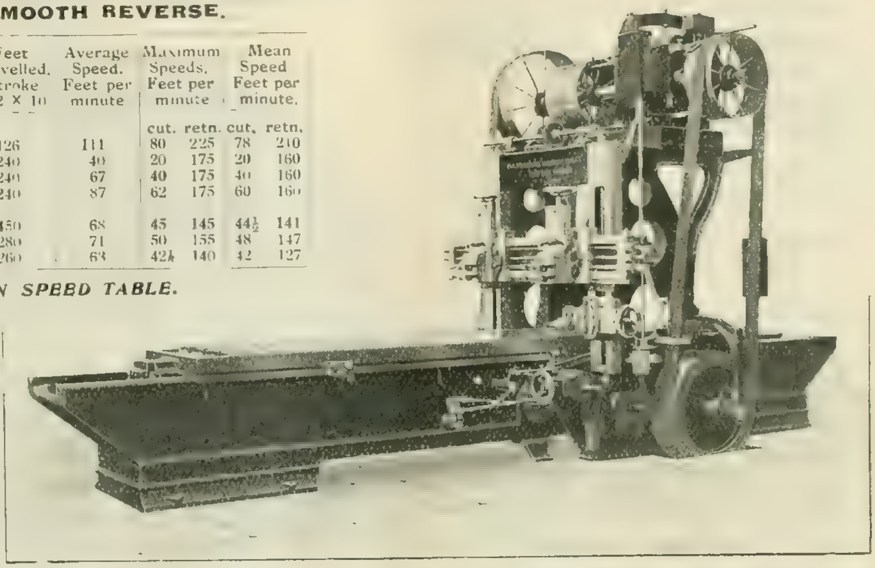

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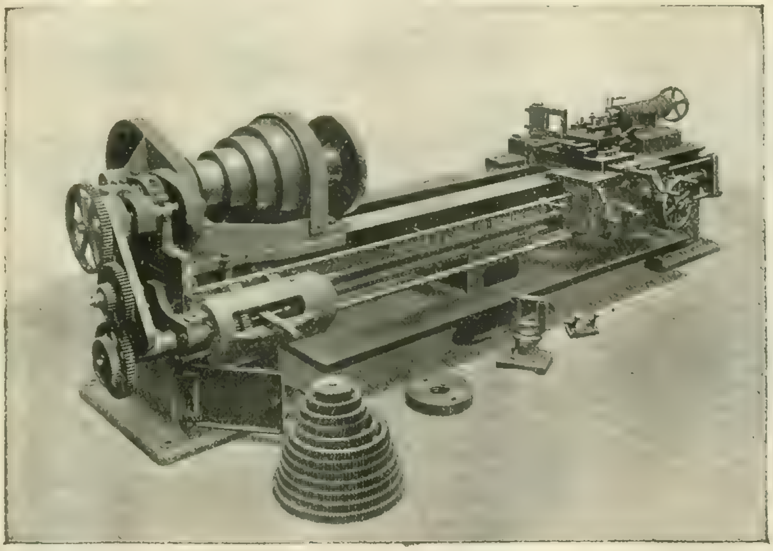

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LATHES

A Speciality.

"ACCURATE."
"DURABLE."
"POWERFUL."

8½ in., 10 in., and 12 in.
Centres.

REASONABLE IN PRICE.
UNEQUALLED IN POWER.

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Porcelain.
Gustav Richter, Charlottenburg, near Berlin, Germany.

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Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

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Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

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Drum Engineering Co., 33, Brook Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.

Radial Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds
Mitchell, D., & Co. Ltd., Parsonage Works, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Clarence Ironworks, Halifax.

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Head, Wrightson & Co., Ltd., Thornaby-on-Tees.
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Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.
Pohlig, J., Ltd, Cologne, Germany.

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Cambridge Scientific Instrument Co., Ltd. Cambridge.

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Swift, George, Clarence Ironworks, Halifax.

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Williams, J. H. & Co., Brooklyn, New York, U.S.A.

Stampings.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

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Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

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Edward Pryor & Son, 68, West Street, Sheffield.

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Lancaster & Tonge, Ltd., Pendleton, Manchester.

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Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

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Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

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Ed. Bennis & Co., Ltd., Bolton, Lancs.

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Tubes, Ltd., Birmingham.

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Greenwood & Batley, Albion Works, Leeds.
S. Howes Co., 64, Mark Lane, London, E.C.

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Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

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Holmes & Co., W. C., Huddersfield.
Hopkinson, J. & Co., Ltd., Britannia Works, Huddersfield.
Hunt & Mitton, Crown Brass Works, Oozells Street North Birmingham.
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Shaw, Joseph, Albert Works, Huddersfield.
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Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

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Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

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A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

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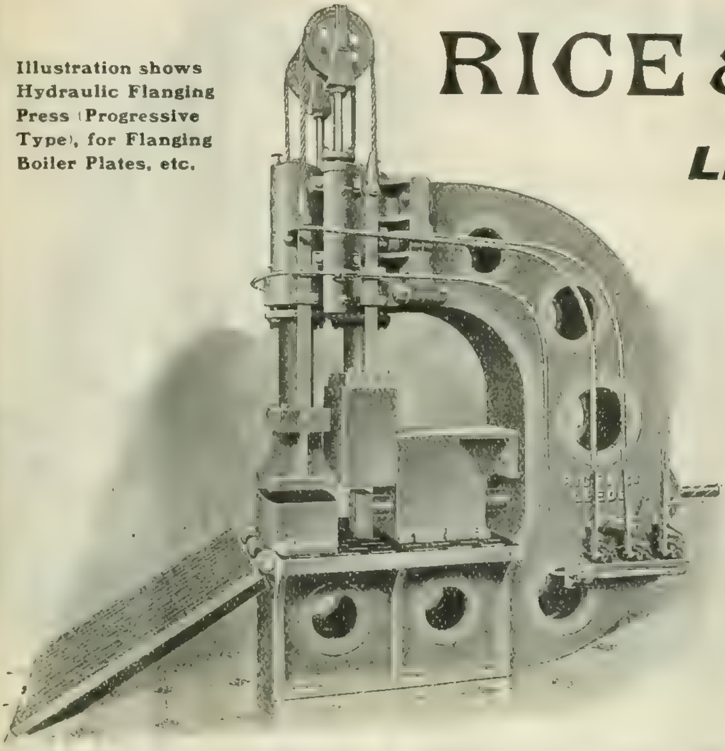

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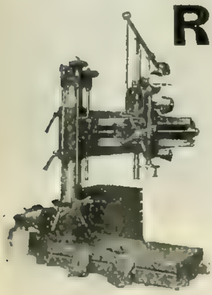

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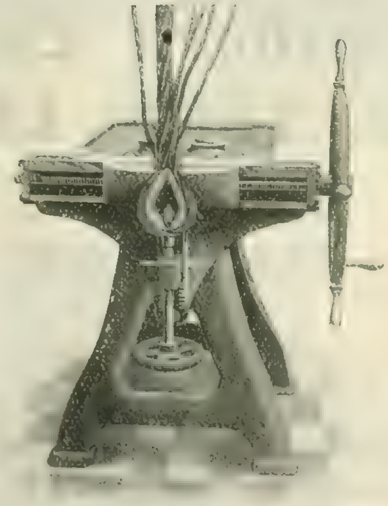

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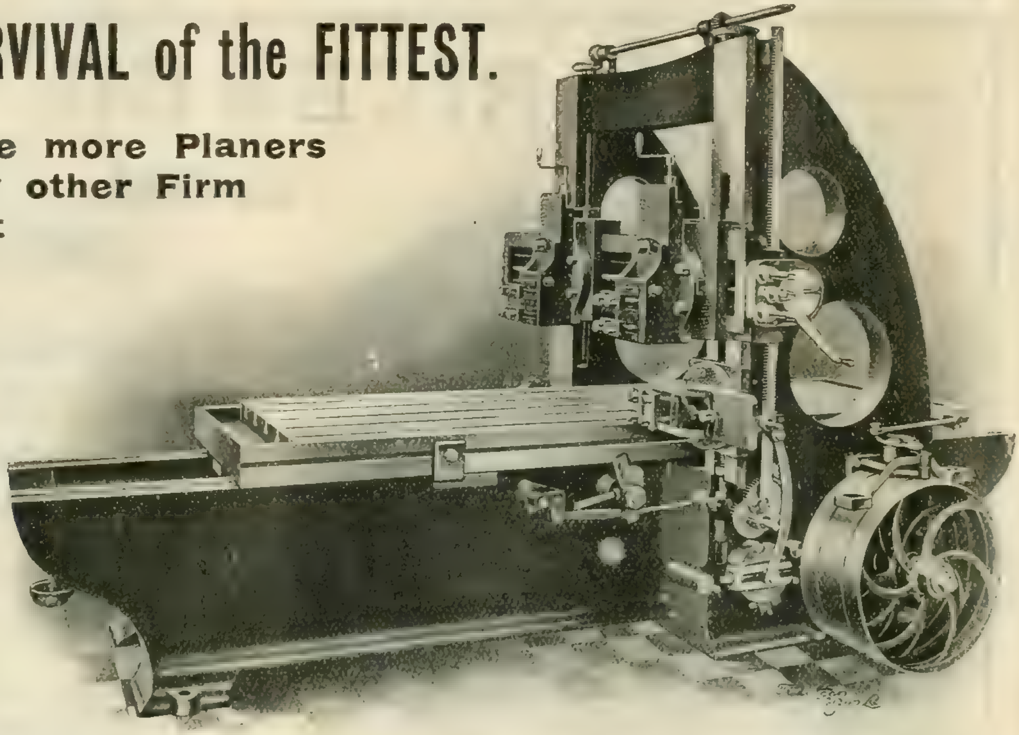

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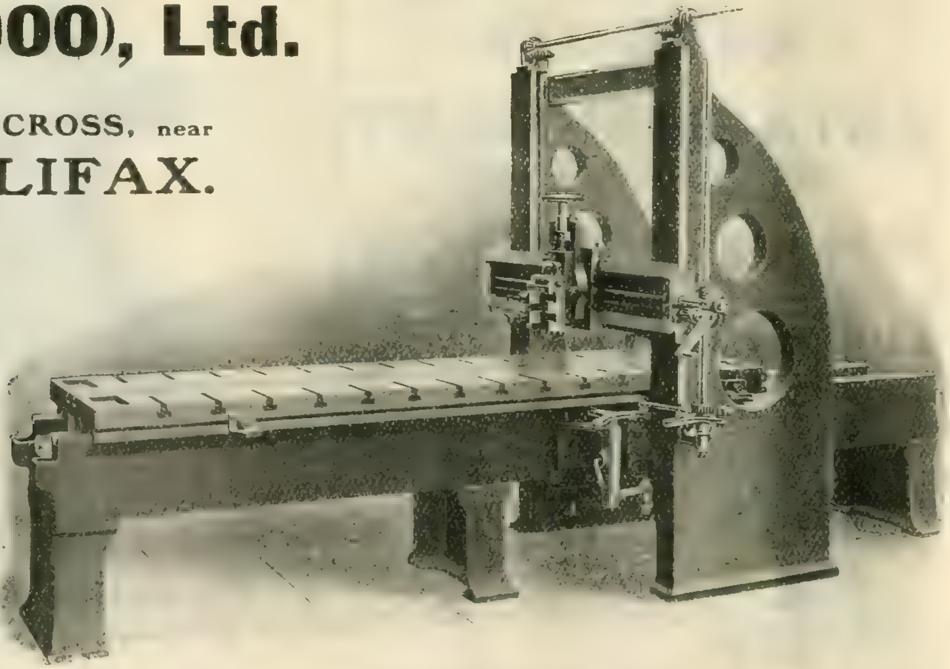

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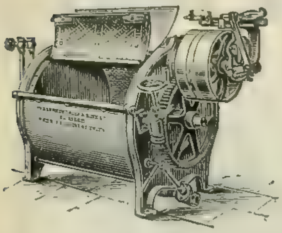

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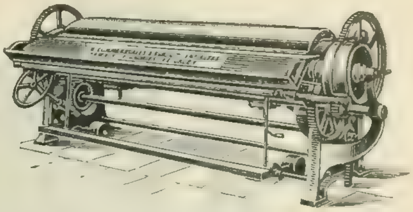

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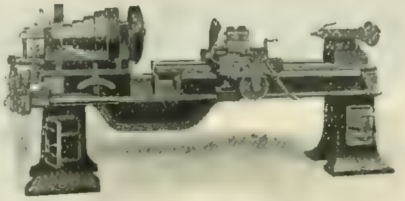

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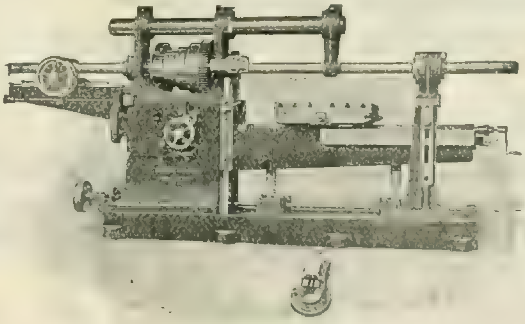

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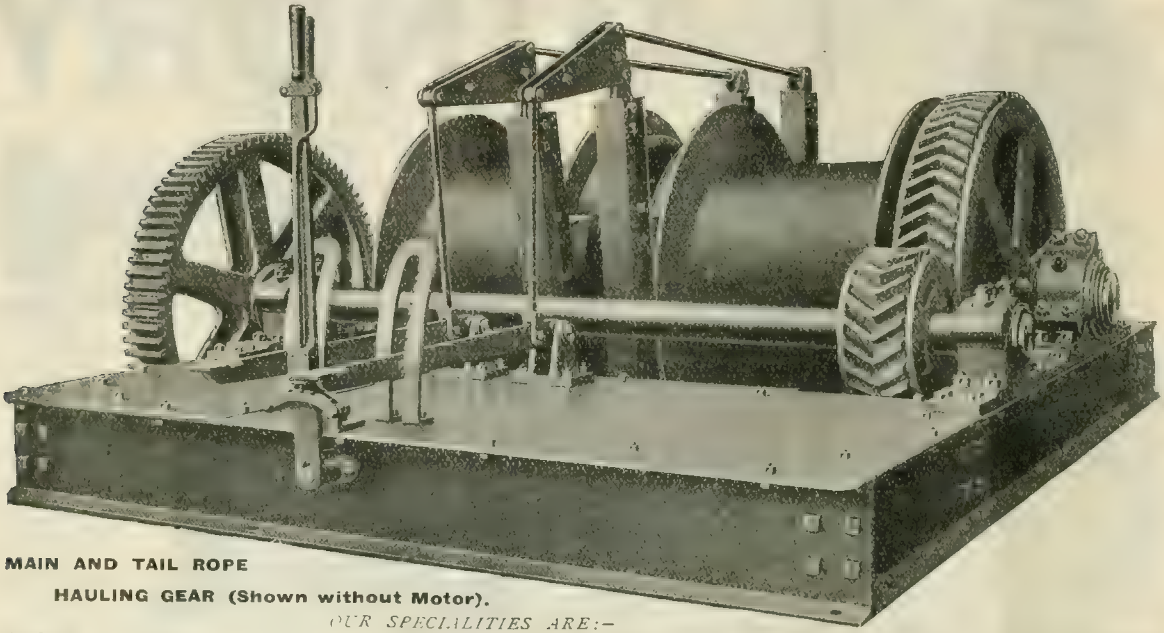

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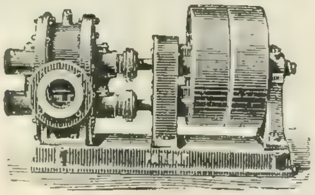

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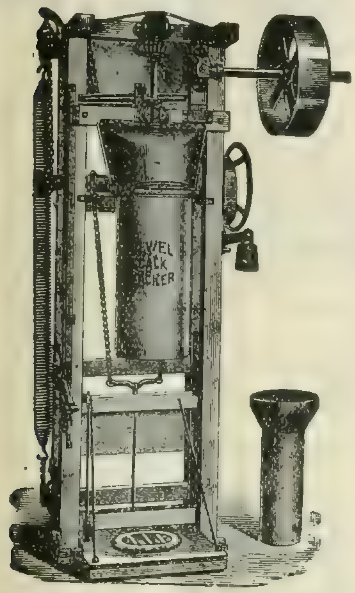

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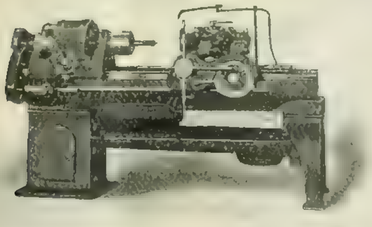

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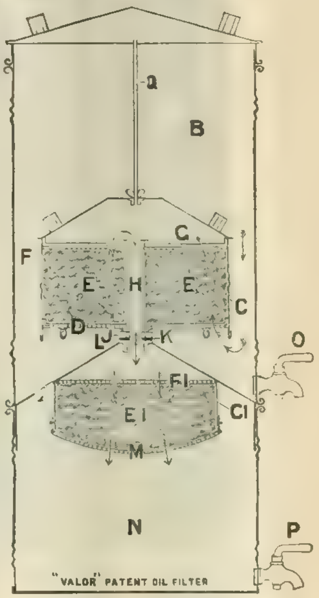
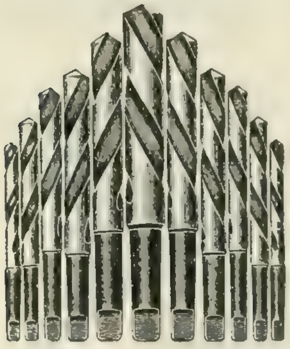


THE VALOR COMPANY, Ltd., ROCKY LANE, ASTON CROSS, **BIRMINGHAM.**



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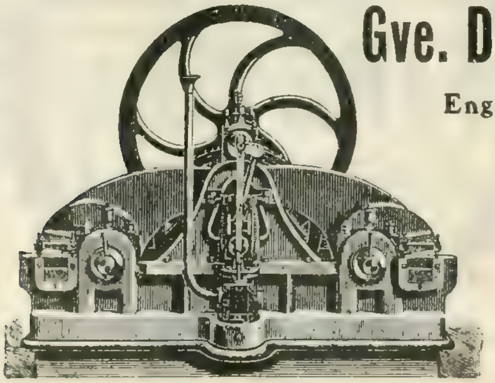

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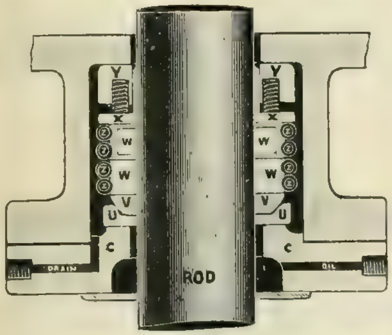

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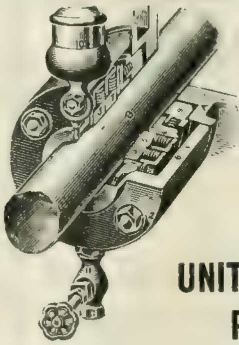

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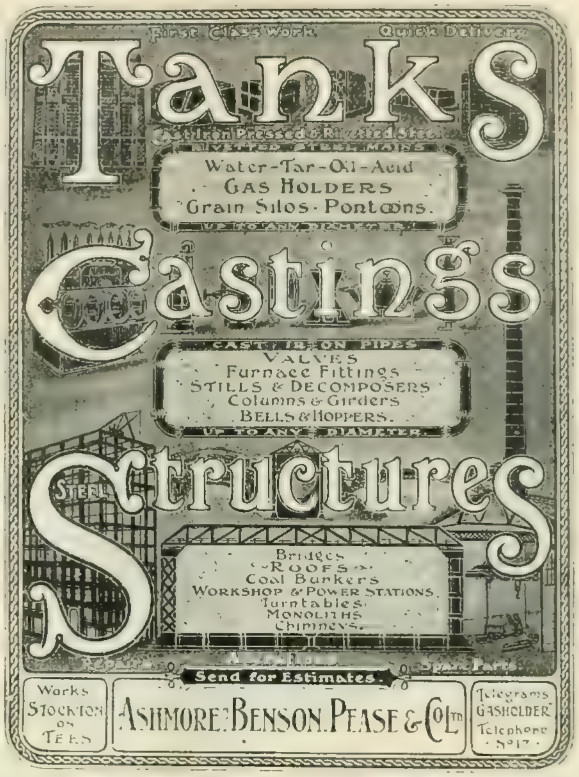

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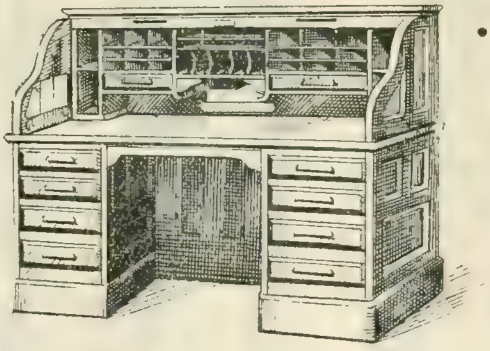

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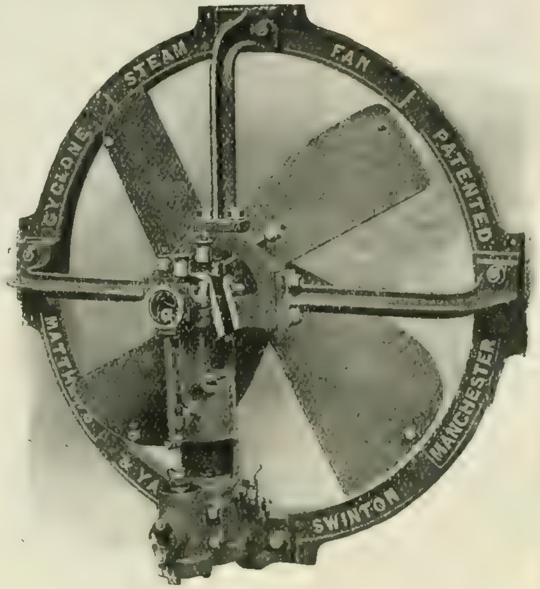

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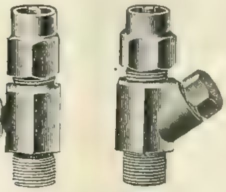

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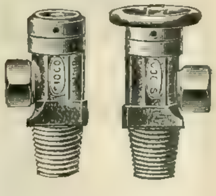

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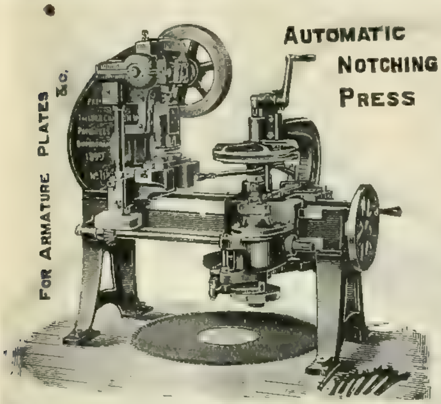

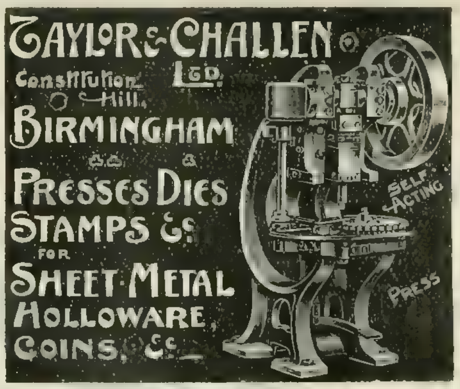
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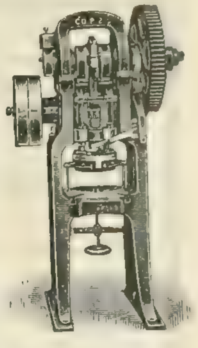
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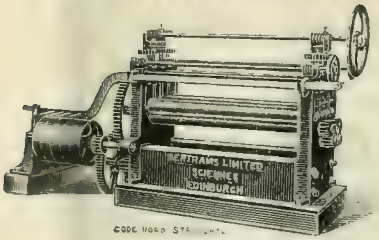

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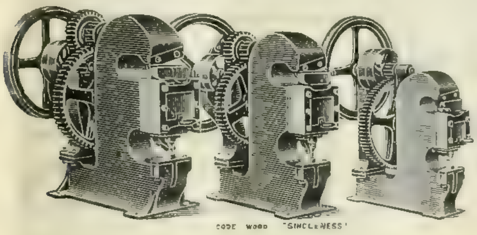

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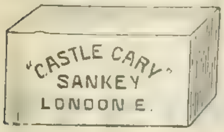

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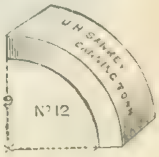

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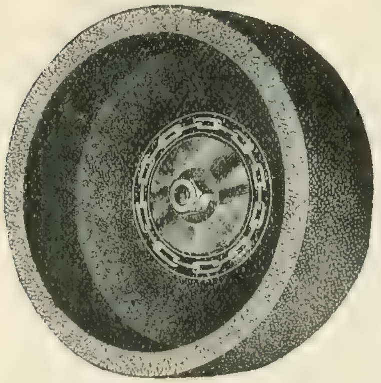

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VIII. LONDON, FRIDAY, JANUARY 5, 1906. No. 69.

The Offices of "Page's Weekly," Wednesday Evening.

SO little knowledge as to the position of the gold-mining industry in Japan is available, that the paper by Mr. A. R. Weigall, which Professor Gowland brought before the last meeting of the Institution of Mining and Metallurgy is particularly opportune. Gold mining in Japan, compared with the large gold-producing countries of the world, is in but an embryo state, and the Empire's gold resources, beyond such as have been proved to a limited extent, are only little known, owing to the small amount and superficial nature of any development that has as yet been carried out.

Professor Rein and Dr. Geerts are of opinion that the future of Japan as a gold-producing country will be not more than a very moderate one. Mr. Weigall's opinion, based on the result of three years spent in an examination of many of the gold mines and prospects in Japan, and opening up some of them to a small extent, is that the future is more hopeful than the above quoted writers would lead one to suppose. Of late years, too, improvements in premises and plants have made it possible to treat at a profit ores which, at the time when Rein and Geerts wrote, would have been put down as unpayable. The excellent mining conditions obtaining in Japan, a cheap and plentiful supply of good miners, abundance of water, and in many cases of water-power, cheap transport and good mining laws, all tend to lessen working costs.

SIR CHARLES SCOTTER, J.P.,
Chairman of the London and South Western Railway, who is now in Egypt inspecting the work in progress on the State railways.

The industry has been steadily progressive, the total output of gold having increased from 80,161 oz. in 1900, to 143,993 oz. in 1902, the latest year for which statistics are available. Of this total, alluvial gold forms a considerable proportion. The total area of mining claims held in Japan, exclusive of Formosa, was 643,919 acres at the end of 1902, divided into five mining districts known as Sapporo, Sendai, Tokyo, Osaka, and Fuquoka. The gold-producing portions of the Empire, at present, are Honshu, Kyushu, Hokkaido, and Formosa. The bulk of the alluvial gold comes from Hokkaido, with some proportion also from Formosa and Kyushu; the chief auriferous deposits, other than placers, occur in Honshu, Kyushu, and Formosa. It is, however, in the mining of auriferous deposits, other than placers, that the bulk of the future gold supply of Japan may be looked for.

As mining methods have improved, more modern workings have gradually replaced the old and irregular galleries of the early era. Better modes of sinking and timbering, and especially the introduction of electrical hoisting, caused a great improvement to take place. Drilling is done chiefly by hand, but at some of the larger mines drilling machines have been nstal'ed. Hand-drilling is done both single and double-handed. Machine drills have until lately only been used for driving and sinking, but at Kosaka and Todoroki they are now used in the stopes. All types of pumps, from the most ancient to the most modern, are to be seen in Japanese mines. In the more up-to-date plants there is a tendency to employ electrical pumps. In many mines, however, pumping is still largely done by means of primitive bamboo pumps worked by hand.

Mr. Weigall gives particulars of a few typical mills. In only one instance is there any real approach to the type of a modern mill. That mill is a 10-stamp wet-crushing mill, arranged in two batteries of five stamps each. The stamps weigh 850 lb., and make 50 drops of 9 in. per minute. The average output is two tons per stamp per 24 hours. After leaving the amalgamated plates the tailings pass over 12 ft. of blankets and a mercury tap, and are then run through a settling box to separate out the slimes. The tailings from the settling box and the pits are trucked to the cyanide plant which consists of three circular steel vats, each of a capacity of 25 tons. Power is supplied by a well-built steam plant, consisting of Lancashire boilers and a 75 h.p. horizontal engine. The mill and the main drives of the mine are lighted by electricity. About 45 per cent. of the gold in the ore is extracted by amalgamation, and 50 per cent. of that in the tailings by cyanide. The ore is difficult to treat. There is great difficulty in obtaining trustworthy figures of working costs, the systems of bookkeeping in many mines being anything but satisfactory, but the working costs of the mill in question are stated at 11s. 10d. per ton.

The population of Japan, not including Formosa, is about 44,000,000. This ensures an abundant supply of mining labour, which is of a high-class as compared with other Eastern nations, and the rate of pay is low. After a considerable experience of most types of miners in the East, Mr. Weigall's opinion is that the value of Asiatic labour is generally seriously under-estimated. The Japanese miner is said to be the best labourer at his price in the world, but intolerant of control and by no means easy for a European to handle. It is rare indeed to find a European possessing the necessary qualities for this work of supervision. The Japanese make good surveyors and essayers. Anyone wishing to interest himself in gold mining in Japan, will find that the requirements of the mining authorities are by no means exacting.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

It is proposed to equip at Vereeniging, a generating station capable of developing 100,000-horse power for use on the Rand.

The preliminary survey for a railway from Adelaide to Perth, which is to be built by the Federal Government, is likely to be commenced very shortly.

The Victorian Government Inspector of Mines, Mr. W. Abraham, considers that the telephone is of considerable utility in the workings of deep mines and that the use of the system can be advantageously extended in Australian mines.

A recent issue of the Sydney Daily Telegraph contains a report of a lecture on "Spark, or Wireless Telegraphy," delivered to the officers, and warrant and non-commissioned officers of the gunnery school by Mr. E. Kilburn Scott, of Sydney University.

The attendance (1,330) at the fifty-second meeting of the American Society of Mechanical Engineers, held in New York, was the best on record. The meeting was largely given over to discussion.

We are advised that the name ofthe Straker Steam Vehicle Company, Ltd., has been altered to that of Sidney Straker and Squire, Ltd., the business of Straker and Squire being incorporated with it. The firm has left 9, Bush Lane, and is now occupying 5, Nelson Square, Blackfriars Road, as temporary offices, pending the completion of new administrative buildings, repair shops, and garage in Nelson Square.

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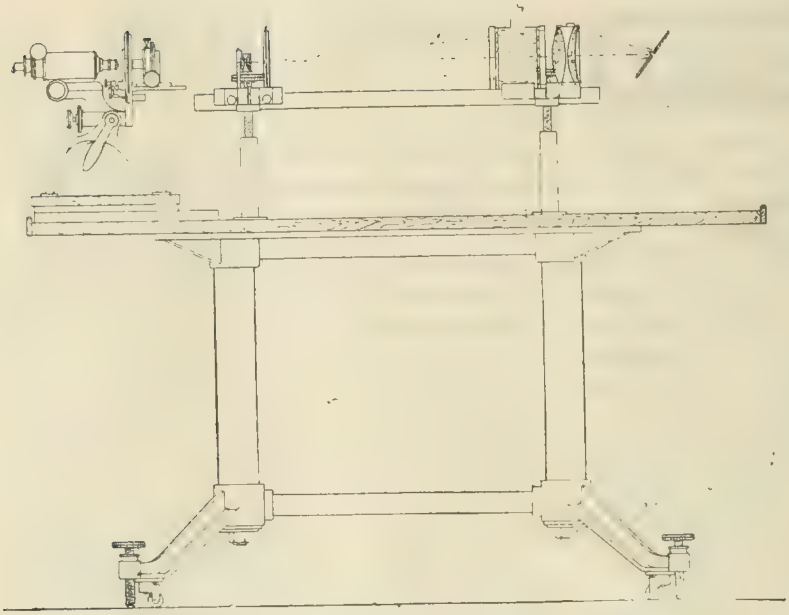


FIG. 1. OPTICAL BENCH, AS ARRANGED FOR MICRO-PROJECTION OR MICRO-PHOTOGRAPHY, ON TABLE COMPLETE.

Metallurgical Microscope.

The Beck type of microscope for metallurgical work is illustrated on this page, the view above showing the optical bench as arranged for micro-photography. Although, of course any microscope can be used for metallurgical work, the distance of the stage from the body is sometimes insufficient for the use of the vertical illuminator and the observing prism at the same time with low powers. It is also a great advantage for this class of work to be able to focus the stage up and down so that the vertical illuminator may be kept stationary after the illuminating beam of light has been adjusted. The Beck microscopes for this class of work are supplied with this focussing adjustment to the stage whereby the distance between the object glass and the stage may be greatly increased. The coarse focussing adjustment is by spiral rack and pinion, so accurately fitted that even comparatively high powers can be focussed thereby.

The Fine Focussing Adjustment.

This is upon a new patented method invented by Mr. Ashe. A strong lever C moves the cradle H, which carries the body of the microscope, by means of the block D, which is a projecting portion of the cradle. The cradle H slides in a fitting in the limb E with a spring acting upon the upper side of the projection D, which drives it on to the lever C. The lever C is moved by a steel screw with milled head A; this screw works through an outer screw which is provided with a large graduated milled head B, read by a folding indicator at F. The screw A has a comparatively coarse thread, and when revolved raises the body of distance of $\frac{1}{60}$ in. in a complete revolution. The screw B has a fine thread, and when revolved carries the screw A with it, moving the body only $\frac{1}{300}$ in. in a complete revolution. At any moment either milled head may be used, giving a moderately fine adjustment for such powers as $\frac{1}{4}$ in. or $\frac{1}{6}$ in., or a very fine movement for $\frac{1}{12}$ in. or $\frac{1}{14}$ in. lens. The convenience of such an arrangement can scarcely be overstated. By clamping the milled head A to the milled head B, or by clamping the milled head B to the limb E by screwing it tightly down, either one or the other fine adjustments may be put out of use. A slow motion fine enough for focussing the highest powers is most troublesome for moderate power lenses.

Mr. William Butler, of Stockport, who is connected with the Birmingham engineering firm of Tangyes, Ltd., is the inventor of a newly-patented camera stand which is to be known as the "Swingcam." This is an arrangement closely resembling the ordinary tripod camera stand in appearance, but provided with universal hinges.

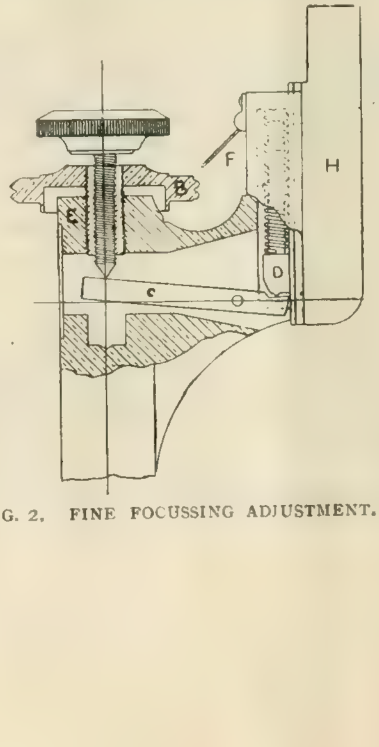


FIG. 2. FINE FOCUSSING ADJUSTMENT.

New Calendars.

The most ornate calendar received up to the time of going to press is from the Brush Electrical Engineering Company, Ltd. This is of large size, suitable for hanging on the wall. Five gilt-framed panels are superimposed upon a background of olive green, the most conspicuous being a view in colours, of the Loughborough works. In the centre of the calendar, below, is a tablet with detachable dates, bearing, if we are not mistaken, aphorisms by famous authors. This is flanked by half-tone views of the firm's traction motor and controller, while in the lower panel are shown Brush standard truck, Radial truck and Brush gear complete. The name of the firm and the address of their head office appear in white lettering.

Messrs. Walter Judd, Ltd., having been at some trouble to design calendars of exceptional utility for both wall and desk use, are apparently disposed to maintain the same design from year to year. As the chief business of a calendar, i.e., to show the date has been well attended to, the recipients are likely to be well satisfied. The wall calendar is one which is likely to appeal to short-sighted people, the days of the week, white on blue, and dates of the month, blue on white, being exceptionally clear. The other calendar is a neat acquisition for the desk.

Mr. E. Arnold Pochin, specialist in gearing and gear cutting, gives us in his wall calendar some useful tables of tooth parts, and the Consolidated Pneumatic Tool Company, Ltd., have included embossed illustrations of the "Boyer" hammer, the "Little Giant" improved reversible drill, and the "Boyer" drill, fitted with angle gear.

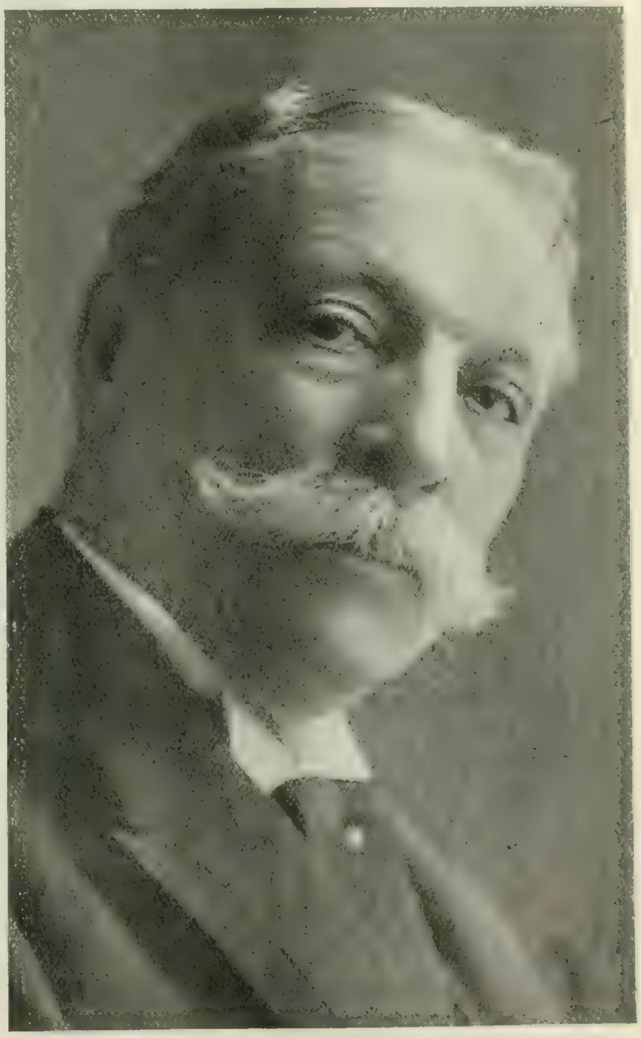
We have also received an illustrated "Date Remembrancer," for 1906 from Messrs. W. H. Willcox and Co., Ltd., 23, Southwark Street, S.E.

Bearing Metals.

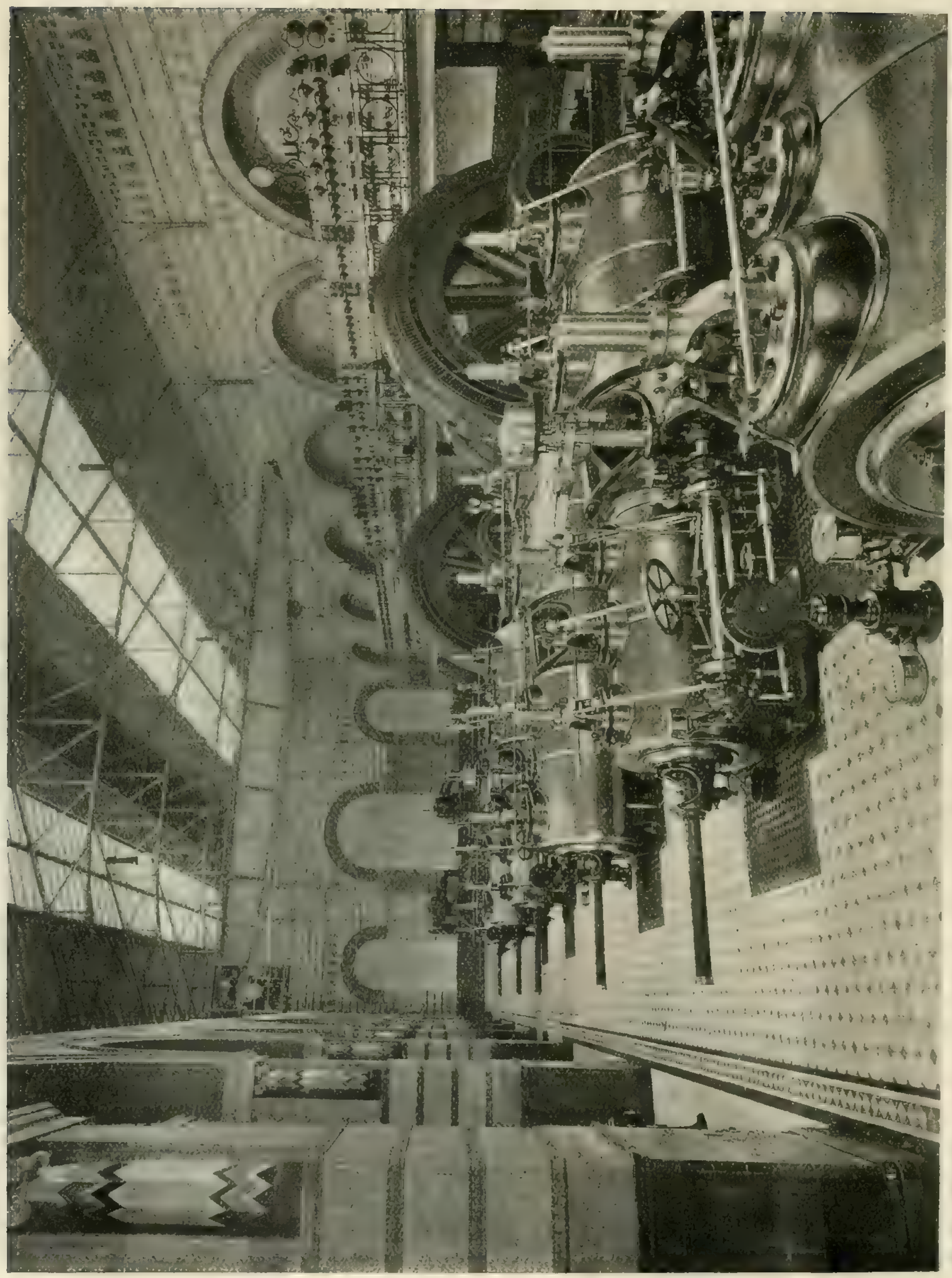
At the recent New York meeting of the American Society of Engineers, Professor R. C. Carpenter referred to the need of a method of making a laboratory test of bearing metals, calling attention to the short-comings of the apparatus and schemes in use. A number of improvements were proposed and in conclusion the speaker said: "In my opinion there is no positive criterion no single definition or specification which can adequately describe a bearing metal which shall be universally satisfactory for all work and conditions."

British Fire Prevention Committee.

At a meeting of the British Fire Prevention Committee on December 20th, Mr. W. Noble Twelvetrees, M.I.Mech.E., A.M.I.E.E., was elected a member of the executive, vice Mr. Lionel J. Langridge, A.M.I.E.E., and was at the same time nominated to serve on the General Testing Arrangements (Standing) Sub-Committee.



THE LATE CHARLES TYSON YERKES.
(*See page* 23.)



MESSRS. HARLAND AND WOLFF'S NEW ELECTRIC GENERATING STATION.

ELECTRICITY IN SHIPBUILDING YARDS.

A NOTABLE example of the application of electrtcity to the shipbuilding and engineering work is the installation recently put down by Messrs. Harland and Wolff. The conversion of the yards from steam to electric driving was carried out by the Electrical Company in conjunction with the electrical engineer to Messrs. Harland and Wolff, and to the courtesy of the former company we are indebted for our illustrations. It should be stated that in order to eliminate power-consuming intermediate links between the motor and the machinery individual driving has been chosen for a majority of cases. Motors aggregating some thousands of horse-power are now running. In general, it was the desire of the designer to make the motor and its attachment an intrinsic part of the whole machine, while saving of space, ease of manipulation, and suitability for hard and rough usage also received due consideration.

In fig. 1 we illustrate three electrically-driven vertical log saw frames. The saw in the foreground is driven by two series-wound continuous-current motors of 22 h.p. each, arranged on a swinging bracket hinged on the main shaft of the saw, and driving through bronze pinions on to one common spur-wheel. In order to

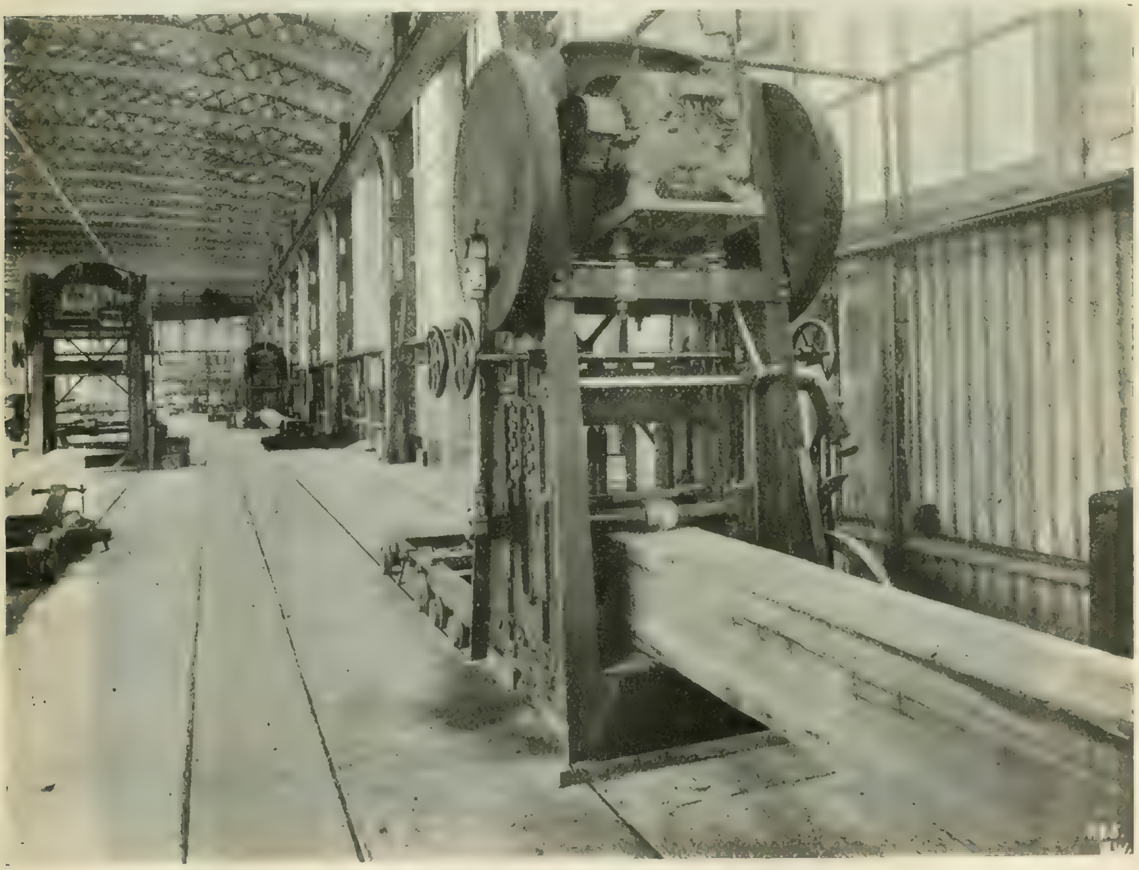


FIG. 1. SHOWING ELECTRICALLY-DRIVEN VERTICAL LOG SAW FRAMES.

relieve the shaft of the weight of the motors the swinging bracket is supported by a set of spiral steel springs, which are bolted to the frame. The speed can be varied from 100 to 200 revolutions per minute by series parallel control. A feature of the drive is that in case the driving motor requires repairing it can be easily removed without interfering with any other part of the machine.

An electrically-driven punching and shearing machine is illustrated in fig. 3. This machine used for steel plates up to 1½ in. thick, and for holes 1½ in diameter is driven by a totally enclosed three-phase 12½ b.h.p. motor of special design at 825 revolutions per minute. The motor is supported on a swinging bracket hinged on the flywheel shaft. A spring suspension is used to balance the weight of the motor, and protect it from the heavy shocks of the machine. To avoid heavy rushes of current on starting the large masses of this machine, a slip-ring type of motor is employed. After starting up the slip-rings are short-circuited, and the brushes raised; the device for effecting which is operated through ropes from the lever of the starting controller. The gearing, which runs at a very high speed, is carefully designed and accurately cut, specially selected materials (gun-metal pinions and steel wheel) being used, with a view to insure freedom from vibration and durability. In order to prevent excessive wear and secure perfect alignment, the motor shaft is provided with an outer bearing which is made detachable, in order to give access to all parts of the gearing.

TYPES OF ELECTRIC DRIVE.

Another type of electric drive selected for illustration is that of the plate-straightening rolls. These are driven by a continuous current totally-enclosed series-wound 8 b.h.p. motor of the tramway type, with special spring suspension. As the masses of this machine are comparatively small, no special braking device is provided in this instance.

In the case of the plate bending rolls the machine is driven by a totally-enclosed continuous-current series-wound tramway type 12-h.p. motor, provided with spring suspension. For quick reversing, an electrically-operated brake, controlled by the lever of the starter, is provided.

Visitors to Messrs. Harland and Wolff's will notice with interest the radial counter-sinking and drilling machine, which has been in use for the past thirty years. Since the introduction of electric driving this

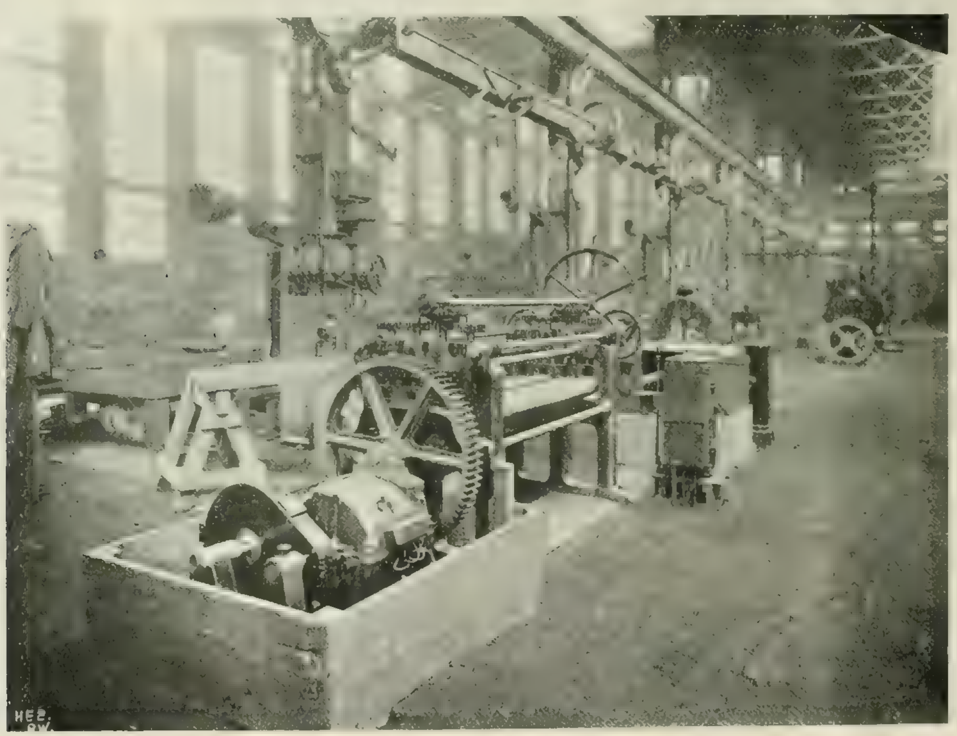


FIG. 2. ELECTRICALLY-DRIVEN PLATE STRAIGHTENING ROLLS.

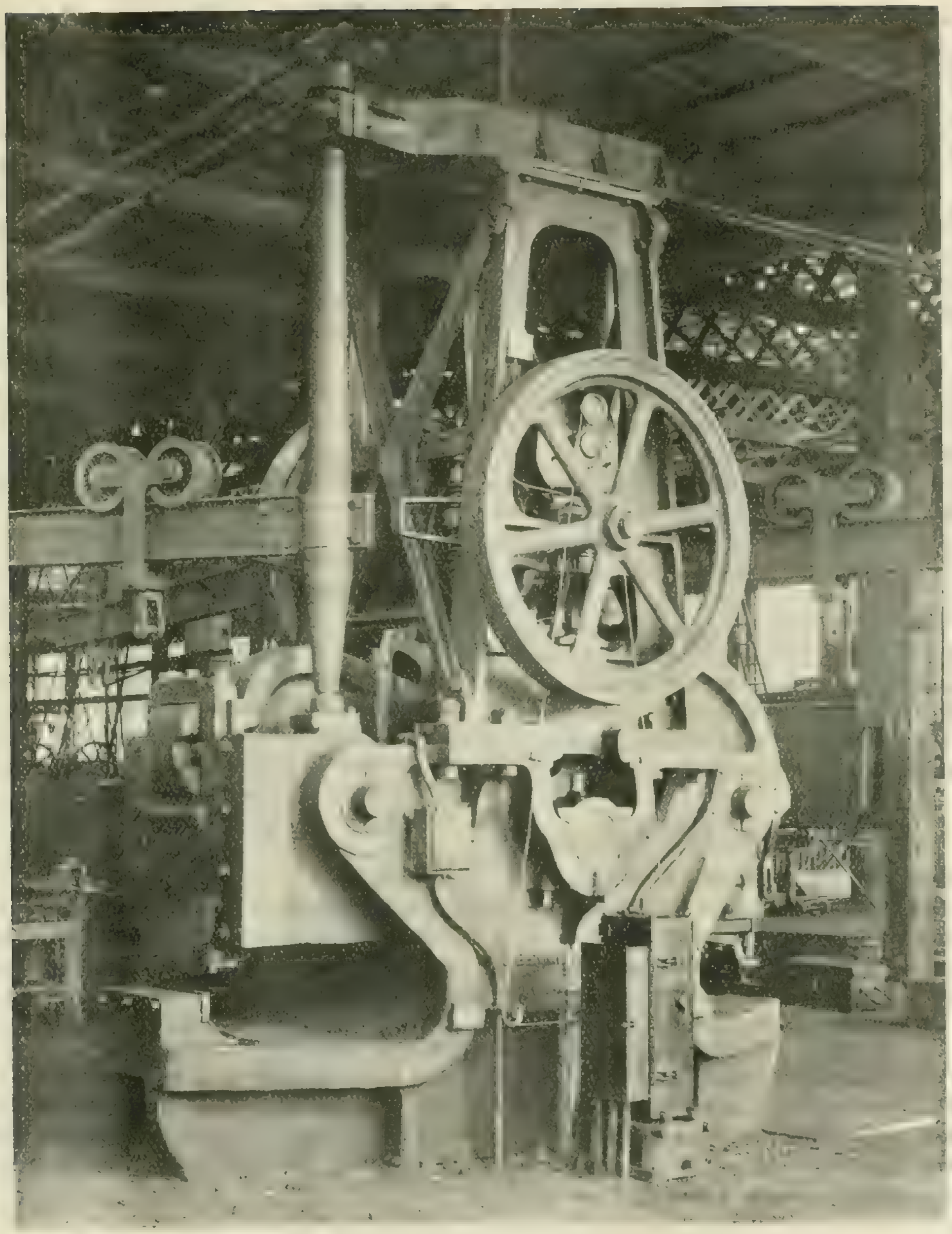


FIG. 3. ELECTRICALLY-DRIVEN PUNCHING AND SHEARING MACHINE.

Driven by totally enclosed three-phase 12½ b.h.p. motor. The motor is supported on a swinging bracket hinged on the fly wheel shaft.

is connected up with a three-phase back-geared motor arranged on the top of the machine. A squirrel cage rotor is used, and the motor is started by a simple switch.

Comparatively small powers are called for in a majority of instances by the adoption of the individual drive, but in the case of the big vertical log saw frame this is driven by two motors of 32 h.p. each, of the type shown in fig. 1. The horizontal circular saw is driven by a three-phase totally enclosed 15 h.p. motor, at 825 revolutions per minute. This saw was formerly driven by belts, which were very inconvenient.

In the case of the pneumatic hammer driven by a back-geared three-phase 8 b.h.p. motor, it is clear that a large amount of torque is required to start up this machine, and therefore a slip-ring type of motor is used, which is able to give about 2½ times the normal torque on starting without excessive current consumption.

In the repairing shop all the machines are driven individualy by continuous current 220-volt motors, arranged to work from batteries when the generating plant is shut down. For driving the lathes the motor is placed below the lathe, and drives by belt and gearing a cone pulley supported on a pivoted bracket. By raising or lowering a weight, a short belt, between the above-mentioned cone pulley and the corresponding cone pulley on the head stock, is tightened or slackened, so that the lathe can be brought to rest quickly, and is not influenced by the inertia of the armature of the motor.

GENERATING STATION.

The generating station recently erected by Messrs. Harland and Wolff illustrated on page 6 occupies a site 409 ft. by 68 ft. The engine house is 171 ft. [illegible] in. long and gives accommodation for three Sulzer-Lahmeyer generating sets, each consisting of a horizontal triple-expansion engine of 1,000 i.h.p. with surface condensation. Two of these drive both continuous and three-phase electric generators, each of [illegible] killowatt normal output, the third engine being connected to a three-phase generator only. The subsidiary plant includes four generating sets, aggregating about 1,000 h.p. The boiler house contains a group of single-ended boilers of the marine type constructed by Harland and Wolff, each capable of generating 10,000 lb. of steam per hour at 200 lb. pressure per square inch. Current is generated at the pressure of 450 volts, and is distributed from the central station by means of underground feeders.

OPENINGS FOR TRADE ABROAD.

British India.

The East Indian Railway Company are prepared to receive tenders for the supply and delivery of spans for Jumna Bridge (160 feet centres of bearings, and 40 feet land spans), as per specification to be seen at the Company's Offices, Nicholas Lane, London, E.C. Tenders are to be sent to the Secretary not later than the 17th inst.

The Directors of the Great Indian Peninsula Railway Company are prepared to receive tenders for the supply of stores, including asbestos, bellows and forges, anvils, lifting jacks, etc. Specifications and forms of tender may be obtained at the Company's Offices, 48, Copthall Avenue, E.C. Tenders must be delivered on Thursday, the 11th inst.

Italy.

At a meeting held at the Chamber of Commerce at Lecco, it was decided to request the Government that the system of electric traction at present in force on the lines of the Valteline, should be extended to Lecco-Milan, Lecco-Bergame, and Ponte San Pietro-Usmate.

Paraguay.

The Paraguayan Government intend constructing a metre gauge railway from a point on the River Paraguay near San Pedro, through rich forest lands and through the Yerba-matê district, with the idea ultimately of terminating at the frontier of the Brazilian State of Matto Grosso.

Liberia.

The United States Consul at Monrovia reports that, from the physical aspect of the country, as well as the natural contour of Liberia's coast line, motor boats would supply a long-felt need in districts which are entirely without facilities for communications except those of the traditional canoe. The largest boat now used measures about 50 ft. in length and 12 ft. beam, with a propelling force of 15 horse-power. It is constructed so as to be able to use either gasoline or kerosine oil. The latter, however, has the preference.

France—Tunis.

The Journal Officiel of Tunis reports the formation at Soussa of an electrical undertaking under the title "Compagnie Electrique de Sousse," which will erect an electric power station at that town, and will also deal in electrical apparatus.

AN ENGINEERING RETROSPECT.

SOME POINTS OF INTEREST IN 1905.

CIVIL ENGINEERING.

The piercing of the Simplon, with its 12½-mile tunnel, commenced in 1898, deserves first rank in any review of engineering progress in 1905. The indomitable perseverance of the engineers in overcoming inundations of hot water and the very accurate surveying which resulted in a difference of less than 4 in. in the levels of the two borings at the junction under the mountain, were the subject of enthusiastic comment throughout the world.

The opening of the 650-ft. bridge over the Zambesi served to complete a very important link in the projected Cape to Cairo route. As the symbol of progress in those remote regions it was an appropriate meeting place for the members of the British Association who journeyed to South Africa.

The progress made with the St. Lawrence cantilever bridge, with a total length of 3,228 ft., we chronicled a few weeks ago.

The Panama Canal, true to tradition, is proving a stumbling block to the United States, where a multitude of advisers are at loggerheads. The sea-level canal recommended by Mr. John Wallace seems as yet very much "in the air."

In Egypt, although the raising of the Assuan dam has been postponed, the work of strengthening the structure is being actively carried on. A new barrage is to be carried out at Esneh. The Rodah Bridge at Cairo, at the hands of Sir Wm. Arrol and Co., is already making good progress.

Among prominent civil engineering projects at home we must not omit to mention the new 1,000-ft. transporter bridge opened between Widnes and Runcorn, with a travelling platform carrying as many as three hundred passengers and four vehicles in a journey occupying some 2¼ minutes.

Another remarkable project completed has been the Hodbarrow sea wall, enclosing 170 acres and constructed in five years at a cost of about £500,000.

The London and South Western Railway have provided one of the largest if not the largest graving docks in the United Kingdom at Southampton. Among other kindred enterprises may be mentioned the widening of the Admiralty pier at Dover, important dock extensions at Liverpool, and a deep-water dock to be constructed on the Humber at Immingham, near Grimsby, the large new dock constructed for the Clyde Navigation Trust, at Clyde Bank, the erection of a transporter bridge over the river Usk for the Corporation of Newport, the improvement of Durban Harbour, the opening of the large dock at Nagasaki, commenced in 1902, and a projected scheme for largely improving the port of Antwerp.

At the present time a movement is on foot in favour of resuscitating in some way our much neglected inland waterways. A commission is to be appointed to inquire into the whole question.

LONDON TRAFFIC PROBLEMS.

London traffic has undergone marked changes. It is very unlikely that the sweeping reforms, advocated by the London Traffic Commission in their long-anticipated report, will be put into practice for many years to come, the broad main avenues proposed savouring rather of Utopia than London, but in the meantime we have added the Kingsway and Aldwych to our possessions and the constitution of a special Traffic Board is a recommendation which commends itself as at once practicable and desirable. The shallow underground tramway which has been constructed under Kingsway is the first of the kind in England, and the example may possibly be followed in other main thoroughfares, where surface tramways are out of the question. The advent of at least two hundred hustling motor 'buses is said to have already sounded the death-knell of the horse omnibus and we have a much-maligned fleet of Thames steamers, which, at the time of writing, is more "continuous" than remunerative. The House of Lords is scarcely likely to persist in vetoing the passage of trams across the bridges, and when this has been accomplished and the new Baker Street and Waterloo tube, now being completed, is opened, much will have been done to improve the facilities for getting about the metropolis. Good progress is, we understand, being made with the other sub-metropolitan tubes.

The electrification of the District and Metropolitan Railways have been successfully completed, and the sulphurous fumes that Londoners are never likely to forget have given place to whitewash. We hope to see the service still further improved in matters of detail. The wider adoption of the all-steel car is another significant feature of current railway practice. In September we illustrated the first steel railway carriage constructed in this country for the Great Northern, Piccadilly and Brompton Railway.

MECHANICAL ENGINEERING.

A good deal of discussion was excited by a report presented to the Steam Engine Research Committee of the Institution of Mechanical Engineers, dealing with experiments by Professor D. S. Capper on jacketed and unjacketed cylinders. It was shown among other things that for an unjacketed engine with a given ratio of expansion, initial condensation, expressed as a percentage of the steam in the cylinder, diminishes with increase of initial temperature, while the total condensation per stroke increases with such temperature increase. This, though suggested by Messrs. Callendar and Nicholson's researches, has never previously been demonstrated with clearness, as if leakage is not allowed for, the results are obscured and even reversed, and the conclusions arrived at without leakage allowance are therefore unreliable.

In his presidential address, before the Junior Institution of Engineers, Mr. Dugald Clerk, M.Inst.C.E., admitted that his view of the future of the gas turbine was not favourable. It called for the evolution of an efficient turbine compressor, comparable in efficiency with cylinder compression; an efficient nozzle expander with a higher efficiency than 90 per cent.; and an efficiency of conversion of kinetic energy of the moving gases into work delivered at the turbine spindle, of greater than 80 per cent. In view of the fascination of the subject, however, Mr. Clark thinks that many inventors and scientific men will doubtless continue to investigate the problem, and possibly new solutions may be discovered which are not dreamt of to-day.

Trials of suction gas-producer plant by the Highland and Agricultural Society of Scotland established the remarkable result that an engine developing 20-brake horse-power can be run at a cost of about one penny per hour.

We do not remember any very enthusiastic comments on the Liége Exhibition, the effects of which, as far as engineering is concerned, do not appear to have been in any degree epoch-making.

It formed an interesting venue, however, for the summer meeting of the Institution of Mechanical Engineers, the papers read dealing with large gas engines, electric colliery winding gear, superheating in locomotives, manufacture of cartridge cases, the strength of columns, etc.; also as a meeting place for the International Congress of Mining, Metallurgy, Mechanics and Applied Geology.

Among the various subjects dealt with at the Liége meeting of the Institution of Mechanical Engineers, the most appropriate was probably that of M. Rodolphe E. Mathot, of Brussels, on the growth of large gas engines on the Continent. Members had the opportunity of inspecting some of the installations described, with the subject fresh in mind, and the paper will serve to remind inventors that the large gas engine, though marvellously developed during the past five years, is still capable of improvement.

Side by side with the growth of electric traction, locomotive engineers are strenuously seeking by endless experiment to improve the steam locomotive, much attention having been lately given to the question of superheating, while compounding is again receiving marked attention.

The longest non-stop run by a regular train running under schedule is that of the Great Western Railway Express which runs regularly between London and Plymouth, a distance of 245¾ miles, without a stop, at the average speed of 55.64 miles per hour.

The installations of steam turbines in the large power stations referred to elsewhere has been one of the most significant features in engineering during the year.

The important work of the Engineering Standards Committee has been steadily continued during 1905. A memorial has been presented to Government with a view to placing the National Physical Laboratory upon a satisfactory financial footing.

NAVAL PROGRESS.

Lord Selborne's scheme for the distribution and mobilisation of the British war fleets has been put into execution. The obsolete war vessels were sold off at the end of March; nucleus crews have been established and a chain of naval bases has been linked up. The important blue book recently issued has placed the status of engineer officers on a satisfactory footing.

As regards naval construction, during the year under review, 37 vessels of the aggregate displacement of 173,550 tons have been passed from the completing stage to the commissioned list, comprising five battleships, of the *King Edward VII.* class; five armoured cruisers, of the *Devonshire* class; seven scouts, three third-class cruisers, and 17 destroyers. In 1904 there were only 30 vessels completed (including five battleships and six armoured cruisers), displacing in all 132,150 tons.

During the past year there have been launched two battleships, four armoured cruisers, one scout, and eight destroyers with an aggregate displacement of 94,400 tons, as compared with 25 vessels of 1904, aggregating in displacement 115,000 tons.

At the present time much naval interest centres in the battleship *Dreadnought*, which is to be the largest and most powerful in the British navy. She will be propelled by steam turbines and will carry an exceptionally heavy armament.

SHIPBUILDING.

We seem to have entered upon an era of large ships. The *Amerika*, built by Messrs. Harland and Wolff, has now gone into the regular service of the Hamburg-American line, triumphantly leading the way with her 35,500 tons displacement.

Another feature of the year has been the rapid rise of the turbine for marine propulsion. From the first turbine torpedo boat *Viper* to the *Carmania* seems a far cry, yet the *Viper* was built as recently as 1898. The *Victorian* and the *Virginian* of the Allan Line, are driven by turbines of 10,000 h.p. The first-named made 19, and the second vessel 19½ knots on the trial trip, and they have broken all existing records over their own trans-Atlantic route. The *Carmania*, whose turbines are over 21,000 h.p., has made 20·4 knots on trial. This vessel (displacement 29,800 tons), fitted with turbine engines has given a good account of herself as compared with her sister ship the *Caronia* (reciprocating), but it is said that the ships will both be eclipsed by two further new turbine steamers which are at present being built for the Cunard Company.

The turbines and reciprocating engines in the Midland Railway Company's steamers were dealt with at the summer meeting of the Institution of Naval Architects. The figures produced threw some light on the relative economy not only of the two systems of propulsion at various speeds, but on the different arrangements in the two turbine steamers themselves. They showed that from 14 knots to 20 knots the turbine is more economical. The maximum difference occurs between 19 and 20 knots, which is the working speed of the vessels on service. In the case of the *Londonderry* the decrease in water consumption amounted to 8 per cent., and in the case of the *Manxman* to 14 per cent., as compared with the *Antrim* and *Donegal*.

In connection with the development of the turbine for marine work, it is interesting to note the attempt being made to apply the internal combustion engines to the needs of the marine engineer. The prediction is made that important developments will be made on the lines of producer gas-engines for this work. Progress has also been made in the direction of perfecting means of submarine signalling, successful experiments having been achieved by the Millet apparatus

The launch of the Japanese battleship *Katori* at Barrow served as a practical reminder of the origin of Japan's victorious navy. The port of Kobe, by the way, now boasts of a shipbuilding yard which is prepared, it is said, to compete with any firm in the East or West in the matter of shipbuilding.

ELECTRICAL AFFAIRS.

Since the visit of the British Association to South Africa we have been bombarded with discussions on the projected scheme for transmitting power from the Falls to the Rand, 745 miles distant. Although the greatest distance over which power has hitherto been transmitted is 230 miles, it seems probable that the engineering problem will be successfully overcome. Whether it will pay as a commercial speculation is another matter.

As our contemporary, the Electrical World, remarks: The concrete proposition is the feasibility of competing at the end of such a transmission with power generated by steam or gas engines on the spot or within the scope of an easy distribution. As a mere engineering feat the transmission of the power presents no forbidding difficulties. Half of this distance has actually been covered in California, and with only 50,000 volts pressure at that. But the probability of dividends is quite another matter, and one of far more dubious issue." Cheap coal from the Wilbank collieries —90 miles away—has also to be reckoned with.

At Niagara there are now no less than six power stations, completed or under construction, the output of which will approach 700,000 horse-power.

The question who is to supply London with power is a burning one at the time of writing, and with five or six schemes in the field it is by no means easy to predict the outcome. The attention of Londoners has been prominently drawn to electrical matters by the highly successful exhibition held at Olympia and by several local exhibitions at Holborn and Paddington.

A notable development in contemplation is the electrification of the South London line of the London, Brighton and South Coast Railway by means of single-phase current.

By way of supplementing the review of American engineering in last week's issue, we may quote some figures given last week in the Railway and Engineering Review, illustrating the present position of the United States' electric railways: Maine has 18 electric railway systems, operating a total of [illegible] miles. New

Hampshire with 14 roads operates 292 miles; Vermont, 9 roads and 112 miles; Massachusetts, 73 roads and 2,734 miles; Rhode Island, 9 roads and 403 miles; Connecticut, 26 roads and 687 miles; and New York, 106 roads and 3,192 miles. The total mileage of all the States given is 7,798. These figures include street railways as well as inter-urban lines.

The advance of electrical driving in works and factories is illustrated by the opening of the Lancashire Power Company's system with an initial load of more than 4,000 h.p., the Radcliffe Power Station of the Lancashire Electric Power Company, the new Thornhill Power Station of the Yorkshire Electric Power Company, and the construction of large power stations at Yoker and Motherwell by the Clyde Valley Electrical Power Company. The completion of an extensive electric generating station at Messrs. Harland and Wolff's shipbuilding works has also been chronicled.

The main underground telegraph line from London to Glasgow has been steadily proceeded with, and the news of its completion reaches us as we go to press.

The Engineering Standards Committee published during the year the results of some important temperature experiments on field coils of electrical machines to determine generally the relation between the maximum temperature in the interior of any coil taken by means of a thermo-junction, and the mean temperature of the same coil taken by rise in resistance.

Radio-activity has been discussed in a notable series of lectures by Professor J. J. Thomson, and considerable attention has been directed to Professor Fleming's investigation of the behaviour of high frequency currents which has an important bearing on the development of wireless telegraphy.

Mr. H. W. Ravenshaw, in his Cantor lectures at the Society of Arts, dealt with the uses of electricity in mines, in which he clearly showed the advantages which follow the introduction of electrical appliances. Among the subjects discussed at the Institution of Electrical Engineers were the electric power problem, international electric units, and the need for reform, while Mr. Donald Murray exhibited a machine which showed the latest progress made in the direction of typesetting by telegraph.

IRON AND STEEL—METALLURGICAL.

In the iron and steel industry Colonial and foreign enterprise has been a marked feature of the year, but we have it on the authority of Sir James Kitson that the home industry is in, at the present moment, a very satisfactory state.

In Australasia a great deal is being done to exploit the vast native coal and iron resources and determined efforts have been made to establish a steel plant in New South Wales for the treatment of ore raised in the Commonwealth. In India attention has been drawn to the prospective development of rich iron ore deposits in the Rhaipur district of the Central Provinces and the recent extension of the Barakar Steel Works. The report of the Director of the Geological Survey indicates that the prospect for a rich development of the mineral resources of the peninsular are more favourable than ever before. At Lulea are the first ironworks to be established in the north of Sweden, it being proposed to smelt ore from the Gellivare mines, make steel, and roll rails for home requirements by way of a beginning, and later on to manufacture other products. In the East the Government Steel Works of Japan are finding an ever-increasing employment.

The activity which prevails in these and other directions seems to offer strong evidence in favour of the International Iron and Steel Parliament which Mr. R. A. Hadfield suggested at the annual meeting of the Iron and Steel Institute. Judging from Mr. Hadfield's address on this occasion the iron ore supplies of the world are destined to remain for a long time to come an unknown quantity. Perhaps, like British coal supplies, they will continue to increase on paper, while they decrease in fact.

One point brought out by Mr. Hadfield which certainly calls for remedy is that the waste in producing and working up iron is, at present, very heavy, at least 23 per cent. being wasted annually in a pig-iron production of about 50,000,000 tons.

The final report of the Coal Commission as well as the Smoke Abatement Conference later in the year, showed that a colossal waste of coal is in daily progress, in spite of which we have enough to last from 400 to 600 years, the available coal in the proved coal fields of the United Kingdom being 100,914,668,167 tons.

In this connection the development of the Mond Power Gas Distribution Scheme at Dudley Port will be watched with much interest. This enterprise, together with many small gas producer plants points the way to, at least, one important economy. It seems highly probable, however, that long before the expiration of the period mentioned by the Coal Commissioners, engineers will have wrested from nature other and more effective means of power production.

The Sheffield meeting of the Iron and Steel Institute appropriately held in that city during the presidency of Mr. R. A. Hadfield was exceptionally well attended and will be long remembered by those present both for the interest attaching to the numerous papers and for the highly instructive series of visits to neighbouring steel works.

At this meeting it was remarked by the president that although modifications of minor importance are gradually being introduced, it is difficult to see where further radical departures can take place in existing processes themselves or in the machinery employed. It is rather to the material produced that attention is now being specially devoted.

The application of high-speed steel is producing nothing less than a revolution in the machine shop, Mr. Gledhill having shown that steel turning can be done in certain cases at the rate of 500 ft. per minute. Regarding the question of economy there is not only a saving effected on the actual machine work, but the upkeep of these cutting tools is also considerably reduced, owing to the great endurance of high-speed steel, so that the former expensive costs entailed by frequent forging and grinding when using the old steels are greatly reduced.

As illustrating the progress made in the production of ferro-alloys Mr. Hadfield has shown that ferro-manganese containing 80 per cent. manganese, first produced in 1875, and costing, even twenty years ago, £100 per ton, can now be obtained for about one-tenth that price. Nickel and ferro-nickel are now made on a large scale, and at reasonable rates, compared with the almost prohibitive prices of but a few years ago. Many of these special ferro-alloys are being largely produced by means of the electric furnace, in France, in America, in Canada, and elsewhere.

A notable metallurgical contribution of the year was concerned with the results of the investigation of magnetic non-iron alloys by Prof. J. H. Fleming and Mr. R. A. Hadfield. The alloy experimented with was composed of manganese, 22·42 per cent.; copper, 60·49 per cent; aluminium, 11·65 per cent.; carbon, 1·5 per cent.; silicon, 0·37 per cent.; iron 0·21 per cent.; with about 2 or 3 per cent. of slag.

One of the author's conclusions was that the magnetic properties of this alloy must be based on a certain similarity of molecular structure with the familiar ferro-magnetic metals. The hypothesis which best fits the facts of ferro-magnetism is that materials such as iron, nickel and cobalt, are composed of molecular groups, which are permanently magnetic, and that the process of producing or changing the evident magnetisation of a mass of these metals consists in arranging or disturbing the positions of these molecular magnets. Since, then, we have in this alloy an instance of fairly strong ferro-magnetism produced by an admixture of metals possessing in themselves separately no such property, it follows that ferro-magnetism per se is not a property of the chemical atom but of certain molecular groups. The importance of this fact cannot be easily over stated. It shows us that in spite of the fact that ferro-magnetism has been hitherto regarded as the peculiar characteristic of certain chemical elements—iron nickel and cobalt—it may, in fact, depend essentially on molecular grouping composed of a comparatively large number of molecules, and, hence it may be possible to construct alloys which are as magnetic, or even more magnetic, than iron itself.

The results of a research by Mr. R. A. Hadfield have also been published on the effect on mechanical and other properties of iron and its alloys produced by liquid air temperatures.

The seventh report to the Alloys Research Committee by Dr. H. C. H. Carpenter, Mr. R. A. Hadfield and Mr. Percy Longmuir, dealing with iron-nickel-manganese carbon alloys was summarised in these columns as recently as the end of November last.

Metallurgists have had to thank Mr. James A. Gayley during the year for an important contribution on the application of dry air in blast-furnace practice. Whether Mr. Gayley's method of freeing the air of its moisture before passing into the furnace will be universally adopted remains to be seen. It has certainly raised much interest. Mr. E. P. Martin, in his presidential address before the Institute of Mechanical Engineers, remarked that the new process seemed to promise remarkable results, and "those who have had an opportunity of seeing this process at work expect further reductions in the amount of fuel required to make a ton of pig-iron."

Mr. Martin added that "still further economies may be expected by the use of steam-turbines for blast engines, but above all by the introduction and utilisation of blast-furnace gas, and gas from the manufacture of coke, for the purpose of raising power for driving blast and other engines; this is now being followed with the greatest possible interest. The difficulty of cleansing the gas from blast furnaces has now been overcome, greatly reducing the wear and tear of the engines, and blast engines worked by blast-furnace gas, may now be said to be beyond the experimental stage. Many plants, especially on the Continent, are being entirely driven by engines worked with blast-furnace gas, and it is to these and other improvements that we look to still further reduce the cost of making pig-iron. It is almost a question whether the manufacture of pig-iron may not some day be simply reduced to a by-product by the employment of gas for producing power in electrical central stations."

One of the latest ideas which is about to be carried out on a very large scale with regard to rail mills, is, that the roll shall be driven by motors, whose power will be developed by gas engines driven by the gas from the blast furnaces. The power thus obtained will be delivered as current to motors at the rolls, to which they will be connected by gear, and will supplant the present steam engines now in use for driving these rail mills.

An important fact which should be here mentioned is that an international committee for investigating the constituents of steel has been formed at the instance of Professor R. T. Glazebrook and M. H. le Chatelier. The objects of the committee are to undertake the researches with the object of arriving at authoritative conclusions, and of drawing up a common system of nomenclature.

Other features of the year to which attention may be drawn have been the introduction of the dry galvanising process known as "Sherardising" for the protection of iron and steel from corrosion, the cheapening of metallic calcium, and the widely extending use of aluminium.

MINING MATTERS.

The progress made towards the solution of the deep winding problem and the introduction of electric winding on the Rand, the testing of the tube mill and other matters of practical mining interest we are compelled to pass over owing to restrictions of space.

The now famous "Cullinan" diamond found in the Premier mine in January and weighing 3,024¾ carats, has been unquestionably the mining magnet of the year. The diamond is a single colourless crystal, the portion of a much larger stone, but whethe the remaining fragments will ever be discovered is extremely problematical, although the finding of a second large diamond on the same prospect has been reported.

It is interesting to note that from the inception of work at the close of 1902 to August 31st last, the Premier Company treated 2,170,214 loads of ground for a return of 1,578,672 carats of diamonds, equivalent to a recovery of ·72 carat per load, and a larg additional plant is being put down for the further exploitation of the mine. The fact that diamond mines existed at all in the Transvaal was not formerly established until 1897, though the first recorded discovery of a diamond dates back to 1871. De Beers, annual report on the Kimberley mines showed that the diamonds produced during the year realised £4,8[illegible]2,844.

The importation of the Chinese just brought to a standstill by the new Government, whatever may be the political aspects of the matter has unquestionably proved of immense service in developing the Rand mines.

TECHNICAL EDUCATION.

Among other important events in connection with technical education have been the opening of a new electro-technic laboratory at Liverpool University by Sir Joseph Swan and the inauguration of Sheffield's new university with complete technical laboratories by His Majesty the King. The department of metallurgy of the University of Sheffield has had special attention paid to it, seated as it is in a city where the chief national metallurgical industry is carried on. A new technical college has also been opened at Glasgow.

Mr. Carnegie's donation of £2,000,000 to provide annuities for American college professors unable to continue active work is worthy of special notice; also the completion of the extensions to the Carnegie Institute at Pittsburg at a cost of £1,000,000 contributed by the same philanthropist. At home the new Royal College of Science is being completed, and everything points to a concentration of educational forces at South Kensington.

OBITUARY.

Among the deaths recorded during the year have been those of Sir Lowthian Bell, Bart.; Sir E. H. Carbutt, Bart.; Sir Benjamin Hingley,; Mr. James Mansergh; Sir Bernhart Samuelson, Bart.; George Robert Stephenson; Sir Wm. Shelford, and Mr. Charles Brown. The latter assisted Michael Faraday and afterwards played an important part in Continental engineering. As we go to press comes the news of the death of Mr. C. T. Yerkes, who will be regretted by many friends.

NEW YEAR'S HONOURS.

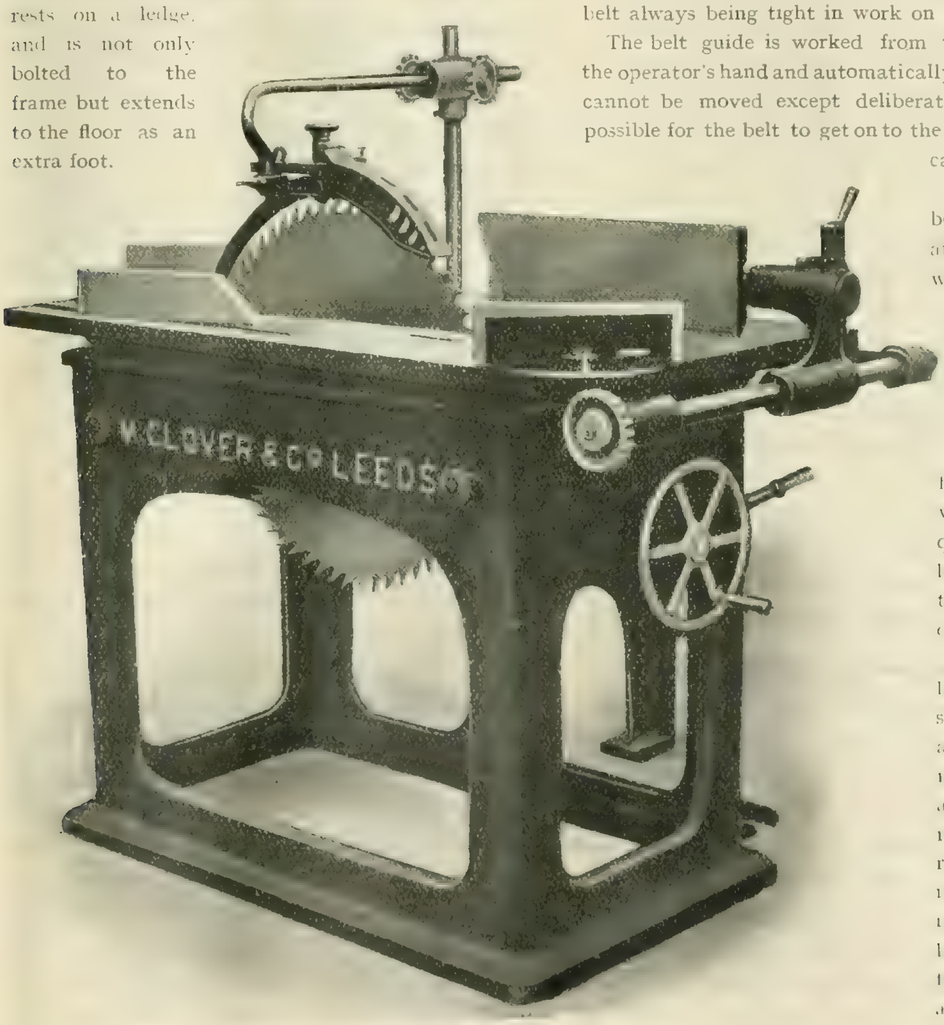
Several names, well known in the engineering world, appear in the recent list of political and new year's honours. Mr. Philip J. Stanhope, M.P., who has been made a peer, was born in 1855; he served in the Royal Navy, saw active service in Egypt, and afterwards became a civil engineer. Sir James Joicey, who is the recipient of a like honour, is in his sixtieth year; he is the managing director of the two largest colliery companies in Durham, and a director of the North Eastern Railway. Mr. Charles H. Wilson, M.P., the shipowner of Hull, was born in 1833; he also has been raised to the peerage, while Mr. A. W. Uglow Pope, traffic superintendent of the Oudh and Rohilkband Railway, has been made a commander of the Most Eminent Order of The Indian Empire.

AN IMPROVED HANDY PATTERN SHOP SAW BENCH.

BY MESSRS. M. GLOVER AND CO., LEEDS.

SOME very serviceable features have been incorporated in the improved design of saw-bench illustrated below. The frame is made all in one casting. The table top rises and falls, being carried by four turned rack pillars which slide in four corner brackets machined to receive them, and cast solid with the frame.

The bearing nearest the saw is fixed upon strong brackets cast in the frame and can be bodily removed and replaced in a few minutes. A massive bracket carries bearing for spindle outside the pulleys which rests on a ledge, and is not only bolted to the frame but extends to the floor as an extra foot.


IMPROVED HANDY PATTERN SHOP SAW BENCH.

The bearings are fitted with interchangeable and reversible brasses. The spindle is of steel with lock-nut arrangements for at once taking up the wear and rattle which otherwise frequently annoy and interfere with good work. The loose pulley is about 1 in. in diameter less than the fast pulley, but has a taper flange leading up to the larger fast pulley so that the belt never hesitates to work from one to the other. This device allows the belt to be slack when on loose pulley, which lengthens its life and saves the bush of the loose pulley considerably, besides insuring the belt always being tight in work on the fast pulley.

The belt guide is worked from the front, close to the operator's hand and automatically fixes itself, thus it cannot be moved except deliberately, and it is impossible for the belt to get on to the wrong pulleys and cause accident.

The guide fence can be swivelled to any angle; it is specially well supported, being capable of taking in wide sawing and has also a fine screw adjustment for most accurate work; it also swings quite out of the way leaving the bench top free for wide or curve sawing.

The table top can be fitted with extra sliding fence for angle work which may at once be adjusted to an index and speedily removed. The gearing is neatly enclosed inside the frame, being thus protected from the saw dust and out of the sawyer's way.

THE KYNOCH GAS PRODUCER.

THE Kynoch suction gas plant consists of three chief elements, a generator in which the gas is actually produced, the vapouriser in which water is turned into vapour, and in that state passed into the fire to supply the hydrogen element in the gas, and a scrubber or purifier. The air for producing the partial combustion is in this form of plant drawn into the generator by the sucking action of the gas engine itself, in taking its charge of gas, and thus no gasholder is required, nor any means for forcing air under pressure through the generator and purifying arrangement to the engine.

The plant about to be described has been designed with a special view to great simplicity without in any way sacrificing efficiency or ease of working. Extended experience has shown that complicated arrangements or devices, however theoretically good they may be, are, or soon become, sources of trouble, and that the simplest design is in the end the best as well of course the cheapest in first cost and maintenance. It is also very important that all parts should be easily accessible, and this is a special feature of this design.

GENERAL DESCRIPTION OF THE PLANT.

Fig. 1 is a general view of the plant in section. A is the generator consisting of a cylindrical casing, having a ring, B, near the bottom carrying the easily removable grate bars. The casing has a firebrick lining, C. The lower portion forms the ashpit. Two doors, D, with metallic joints requiring little or no jointing material to make them airtight, are easily and quickly manipulated, and give access to the lower part of the fire chamber and the ashpit which is level with the bottom of the door so that ashes can be easily raked out.

The top is closed by a lid, F, having a metal funnel bolted to it inside so as to be readily removable if necessary, and carrying a hopper, G, containing at the bottom a valve, H, with metallic seat, and a close-fitting lid, J, by which means fuel can be introduced without the emission of any gas. At the same time the valve, H, can be easily turned out of the way to enable the interior of the fire-chamber to be seen and cleaned if necessary.

The air and steam are introduced by exterior connections, K, below one grate, and the gas is taken off at L, near the top in the same way. A poke hole, M, is provided in the cover through which the condition of the fire can be at any time examined, and if necessary it can be poked or stirred. A similar hole may also be provided in the fire-door.

DETAILS CF VAPOURISER.

The vapouriser for the production of the necessary water vapour is shown at N. It consists of an outer cylindrical casing, O, enveloping a smaller cylinder, P, which is the actual vapouriser. The exterior of the smaller cylinder, P, has a coarse screw thread cut upon it of a rhomboidal section so arranged that the upper surface is inclined downwards towards the root of the thread. If a small stream of water is injected into the top convolution of the thread, it will then run all the way down the screw in close contact with the cylinder body without running over the outer edge of the thread, The internal cylinder is cast in one piece with a tube, Q, up the centre, the connection between the two being obtained

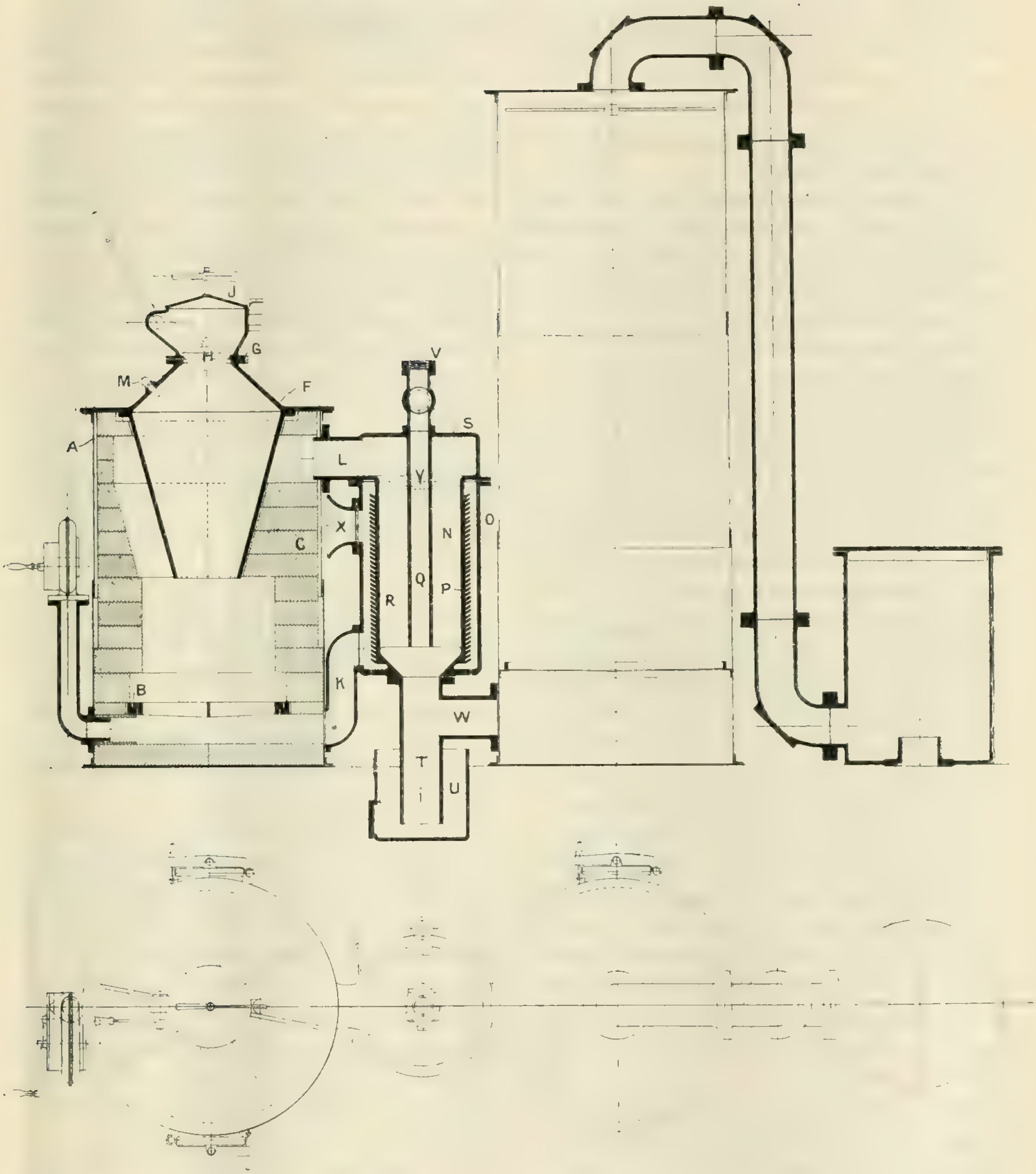


FIG. 1. GENERAL ELEVATION AND PLAN OF PRODUCER PLANT.

by a number of radial ribs, R. The top is closed by a cap, S, except for the central tube which runs through, and a branch, L, at the side of this cap is connected to the gas outlet and the generator. The bottom of the internal part communicates with a plain tube, T, which dips into a vessel, U, containing water, and so forms a gas seal.

Hot gas from the generator passes down the spaces between the radial ribs, R, and heats up the casing, P, of the vapouriser, and the screw thread cut upon it. A trickle of water is caused to run down this thread, which is gradually vapourised by the heat.

The air for the supply of the generator is drawn in between the outer and inner cylinders, O and P, over the screw thread, and so thoroughly mingles with the water vapour there formed before it passes through the connecting pipe, K, to the bottom of the generator. When first starting the imperfect gas is led away up the central tube, Q, through a cock, V, in a pipe to the atmosphere. When good gas is obtained, this cock is shut and the gas then passes out by the tee-pipe, W, into the scrubber. The air is drawn in through an inlet-piece, X, placed close to the generator shell so that it becomes slightly warmed before entering the vapouriser, which is of course, conducive to economy.

This form of vapouriser is easily cleaned. If hard water is used, a deposit of scale inevitably forms on the vapouriser surface, and from time to time this must be cleaned off. To do this the screwed portion, P, is easily lifted out, and as the scale is all formed on the outside it is easily got at to scrape it off. It should be pointed out that this form of vapouriser is more economical than one placed in the generator because the latter uses the direct heat of the fire to generate the steam, whereas the vapouriser described uses the heat of the gases. As it is necessary to cool these gases before they reach the engine, a portion of their heat may as well be used for generating the steam and so save the direct heat of the fire, as well as reduce the size of the cooling apparatus.

REGULATION OF WATER VAPOUR.

To ensure efficient working of the gas engine, the gas must be maintained at a uniformly good quality, no matter what load there may be on the engine. It is therefore necessary to regulate the supply of water vapour to suit the load. For this purpose an automatic arrangement is provided by which a definite quantity of water regulatable at will is supplied to the vapouriser at every stroke of the engine in which a gas charge is taken. If when working below full load, charges are missed in the usual manner, no water should be supplied. If when working light, the water supply is not thus adjusted to the load, the vapouriser becomes flooded, and as the supply of heat to it is at the same time reduced the generation of steam may be altogether stopped and bad gas will at once result.

A lid, S, is bolted to the top of the scrubber, and the gas passes away to the engine through a pipe, T, taken out at the centre of the lid, and by so arranging matters, water from the scrubber cannot get into the pipe. If necessary an expansion chamber may be inserted in the pipe of any needful capacity before it reaches the engine.

Doors, U, to rake out spent coke and deposited dust are provided. When first started the fire has to be brought into a suitable condition before good gas can be made. For this purpose a fan, W, to be worked by hand is fitted to blow air in under the generator grate by pipe, K. A slide valve is provided at the air inlet of the vapouriser outer casing, which is closed while the fan is in use. The imperfect gas is discharged, as already described, through the pipe in the centre of the vapouriser.

When good gas is being made and the engine is started, the fan is stopped, its inlet is closed and the air inlet on the vapouriser opens so that the air passes over the vapouriser surface and gets charged with vapour as described.

THE SOUTH KALGURLI COMPANY'S NEW ORE TREATMENT PLANT.

By ARTHUR C. CLAUDET.

THIS new plant (actual practice) treats 230 short tons per day by dry crushing, roasting, grinding and amalgamating, agitating with cyanide and filter-pressing.

ORE BREAKING.

The ore is delivered at the brace in self-dumping skips, each having a capacity of 30 cwt., and dumped on to a grizzly. All stone under gauge passes through the grizzly into a receiving bin. The remainder is crushed to gauge by a 30-in. by 12-in. Blake crusher.

FINE CRUSHING.

The whole of the ore is fed from a receiving bin on to a belt-conveyor by an automatic feeder. The belt-conveyor rises on an incline and deposits the ore on a cross belt-conveyor, which distributes it by means of trips and shoots in the rough ore bin above the mills. This bin has a live capacity of 300 tons. From the bottom of this bin the ore is fed by automatic feeders to three Krupp ball-mills. A Sturtevant fan exhausts the dust from the ball-mills, and deposits it in the dust-house, in which it is collected and returned to the plant for treatment.

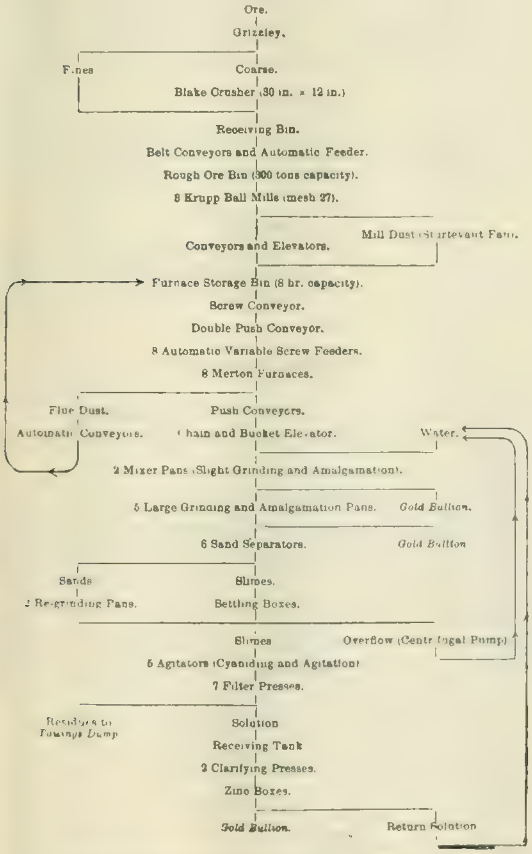

Ore.
Grizzley.
Fines
Coarse.
Blake Crusher (30 in. × 12 in.)
Receiving Bin.
Belt Conveyors and Automatic Feeder.
Rough Ore Bin (300 tons capacity).
8 Krupp Ball Mills (mesh 27).
Mill Dust (Sturtevant Fan).
Conveyors and Elevators.
Furnace Storage Bin (8 hr. capacity).
Screw Conveyor.
Double Push Conveyor.
8 Automatic Variable Screw Feeders.
8 Merton Furnaces.
Flue Dust.
Automatic Conveyors.
Push Conveyors.
Chain and Bucket Elevator.
Water.
2 Mixer Pans (Slight Grinding and Amalgamation).
5 Large Grinding and Amalgamation Pans.
Gold Bullion.
6 Sand Separators.
Gold Bullion
Sands
2 Re-grinding Pans.
Slimes.
Settling Boxes.
Slimes
Overflow (Centrifugal Pump)
5 Agitators (Cyaniding and Agitation)
7 Filter Presses.
Residues to Tailings Dump
Solution
Receiving Tank
3 Clarifying Presses.
Zinc Boxes.
Gold Bullion.
Return Solution

DIAGRAM SHOWING SOUTH KALGURLI ORE TREATMENT.

The fine-crushed ore as discharged from the grinding mills is automatically delivered (by a system of conveyors and elevators) into a storage bin conveniently situated for supplying the furnaces. The bin has a capacity equal to eight hours' run of the mills, so that a casual interruption to the operation of either the roasting or crushing plant does not necessitate closing down the other.

ROASTING PLANT.

The milled ore is roasted or desulphurised in eight Merton furnaces fitted with draught indicators and mercury pyrometers. The ore is automatically fed by a screw conveyor from the bottom of the fines ore bin into the double push conveyor in any quantity as required by the furnaces. The double push conveyor is so arranged that any surplus not required by the furnaces is immediately returned to the fines ore bin; it is situated above the eight Merton furnaces which are fed by eight automatic variable screw feeds.

The waste gases from the furnaces are drawn through a long masonry flue having special arrangements for settling and collecting the dust. The flue terminates at the base of a smoke stack 110 ft. high. The dust as collected in the flue is returned by automatic conveyors, and is delivered into the fines ore bin. Hot ore push-conveyors working in cooling troughs carry the roasted products from the furnaces to a chain and bucket elevator discharging into the mixer pans.

These pans each have a water service connected to overhead supply tanks, and are arranged to run separately and to receive the whole of the roasted ore, or the pans may run together, so that there will be no need of stoppages to clean up. These pans, in addition to intimately mixing the ore with water, to some extent, grind and amalgamate. Before being elevated to these pans the hot ore passes over a pit into which a bad roast may be dropped by means of a slide in the bottom of the conveyor trough and picked up by the automatic conveyors and returned through the furnaces. This pit may also serve the purpose of a receiver for the roasted ore, so that should it be necessary at any time to stop the grinding and amalgamating plants the furnaces may still be kept going.

RE-GR!NDING.

The product from the mixing pans is laundered to five large amalgamating and grinding pans, the ground product being subsequently run into a nest of six sand separators. The overflow as slimes passes over settling boxes, and the underflow, containing all that has escaped being ground to slime in [the five large pans, is passed again through two additional re-grinding pans.

The clear water overflow from the settlers is returned by means of a centrifugal pump to the overhead tanks which supply the mixer pans. The overflow from the settlers, now a thickened pulp, is laundered direct to five agitators.

The product from the two additional re-grinding pans also joins this overflow, and the whole product now slimed is treated by cyanide and agitation. The receiver tanks used in connection with the circulation of the water are in duplicate, and are connected by sludge cocks to the agitators, so that they may periodically be sluiced clear of collected sludge.

FILTER-PRESS PLANT.

The filter-press plant consists of nine presses, seven for slimes and two for clarifying the solutions before precipitating. The presses are filled and washed by means of belt-driven pumps, and a pair of montejus are also connected ready for immediate use as stand-byes. The presses are emptied on to a belt-conveyor which carries the residues out of the mill and on to the dump, delivering at an elevation of 50 ft. above the ground. It will thus be seen that the ore once in trucks underground is never again handled by manual labour, passing through the various stages of treatment and being finally discharged on the tailings dump by purely mechanical means.

CLEAN-UP ROOM.

The solutions from the filter presses are run to a large receiving tank, and are then pumped through clarifiers from which the clear gold solution gravitates to zinc boxes. The spent solution from the zinc-boxes flows to a large sump from which it is raised by a belt-driven pump to the mixer supply tanks. In connection with the water supply there are head tanks of a capacity of 60,000 gallons, a sufficient reserve for two days' treatment. The clean-up room is fitted with a tilting furnace, zinc slimes and amalgam retorts, gold-refining furnaces and all necessary apparatus.

MOTIVE POWER.

The whole of the plant is run by electric motors with power supplied by the Kalgoorlie Electric Power and Lighting Company. The power required has been divided into fourteen units, so grouped that the stoppage of one unit, with its apportionment of the plant, will in no way affect the continuous running of the other units. In addition, an auxiliary steam-drive is arranged in connection with the re-grinding and agitating plants, so that, should the electric power be cut off, these plants may still be kept running. A 20-drill air-compressor has been installed with necessary boiler power and electrically-driven centrifugal circulating pump and air pumps.

RAILWAY SIDING.

A new siding connecting with the Government railway has been built on to the lease, with switches leading to central points for unloading firewood and supplies. Firewood is taken to the Merton furnaces by means of an inclined ramp with two parallel truck lines arranged so that the full truck going down draws the empty one up.

Since the preceding notes were written 27-mesh screens have been put in the No. 8 Mills, and the result has been a marked improvement in the slimes.

PANS.

Separators have been put in, and are now sending the sands only through the pans, and slimes over sand traps.

SAND TRAPS.

Water jets have been fitted to the bottoms.

Compensating weights have been put in use in the re-grinding pans.

Two small classifiers have been installed, and settlers for re-grinding have been attached to two pans.

Analysis of an average sample of the ore :—

Silicious rock, 60·10 ; iron, 7·70 ; copper, 0·12 ; lime, 8·93 ; magnesia, 4·45 ; carbonic acid, 12·45 ; alumina, 1·66 ; sulphur, 0·40 ; arsenic, trace ; antimony, trace ; tellurium, nil ; combined water, 0·90 ; oxygen and loss, 0·23 ; total 100·00.

Gold (per ton 2240 lb.), 14 dwt. ; silver (per ton 2,240 lb.) 6 dwt., 12 gr. ; calcination loss, 9·00 per cent.

The ore contains a very large quantity of carbonates of lime and magnesia.

Communicated to the Bulletin of the Institution of Mining and Metallurgy.

THE LATE CHARLES TYSON YERKES.

IT is to be regretted that the man who had set himself the task of grappling with the London traffic problem could not have lived to see the completion of his work, for the indomitable perseverance which had triumphed over many difficulties would one doubts not, have proved equal to the herculean labour to which he had latterly applied his admitted powers of organisation. Like other American millionaires, Mr. Yerkes made his way from very small beginnings. He was born of Quaker parents in Philadelphia in 1837 and his early occupation was that of a stockbroker and banker, a business which collapsed under the financial stress which followed the great Chicago fire.

Making another start in life, Mr. Yerkes entered the traffic arena, to which for the rest of his life his great abilities were entirely devoted. His first venture in railroad shares was in 1860, when he purchased a controlling interest in the 17th and 19th Street Railway Company, of Philadelphia. Next, in 1875, we find him a large possessor of Continental Railway Stock, in the development of which he was the leading spirit, and his large experience enabled him to make a great success of these companies.

In 1881 Mr. Yerkes opened a banking house in Chicago, in connection with his Philadelphia and New York houses, and in 1886 he made his first ventures in the railway business of that city. His plan was to buy a road that was not doing very well, or that was capable of improvement, and then to set to work to materially increase the receipts while decreasing the expenses, a plan simple enough in conception, but calling for something approaching genius to carry out. As the properties acquired in this way were eminently remunerative it is plain that he had the necessary gifts for the work. The lines included the North Chicago and West Chicago Railway properties, and the Lake Street Elevated Railroad. To form a system of intramural transportation, he built all the lines of the Chicago Consolidated Railway Company, connecting them with these roads. Next he conceived the plan of building a loop line which would connect all the elevated railroads and form a junction road through the heart of the city.

After this got in operation, the receipts increased over 50 per cent., and the elevated railroads from a condition bordering on bankruptcy were now worked at a profit, and began to pay dividends.

His next venture was the North-Western Elevated Railway, which he connected with the Union Loop, this making the fourth elevated railway, and completing the series of elevated roads in Chicago. The total mileage of all these roads is about six hundred miles. After getting the complete system into perfect running order, he was approached by a syndicate, who first purchased the main lines of his combination and afterwards the Chicago Consolidated lines. Some time after this the whole of his elevated railroad interests having been purchased by other parties, Mr. Yerkes decided to transfer his operations to London, where intramural transportation seemed to be no less needed than had been the case in Chicago.

His work in connection with the metropolis is too recent to call for detailed notice. He was chairman of the Underground Electric Railways Company Limited, with a capital of £5,000,000, the main objects of which were to convert the Metropolitan District lines from steam to electric traction, and to construct or complete the construction of and equip the Charing Cross Hampstead, Baker Street Waterloo, Great Northern, Edgware and Watford lines. And of this comprehensive scheme it may be truly said he knew more than any other man, mastery of details being a striking characteristic of Mr. Yerkes. Outside this, the work to which his life was devoted, he took a great interest in science and art. To astronomy he was a munificent patron, establishing the Yerkes observatory at Lake Geneva, Wisconsin, and presenting it with what was at the time the most powerful telescope in the world. He also spent large sums in the collection of works of art, and those, it is understood, have been bequeathed as a trust for the benefit of the American nation. Of his life work it may be said that the plan of opening up the suburbs of great cities, and providing cheap fares, is the best solution which has yet been found to the problem of remedying the overcrowded and unhealthy conditions under which the poor too frequently live.

"LO-SWING" LATHE.

BY THE FITCHBURG MACHINE WORKS, FITCHBURG, MASS.

THE latest product of the Fitchburg Machine Works, Fitchburg, Mass., is a single purpose lathe, for doing work on bar stock of the class that must be done between centres. Its two most distinctive features are, first, a very low swing, just enongh to clear a $3\frac{1}{2}$-in. bar, hence its name, "Lo-swing lathe"; and second, single-slide tool carriages, several of which may be simultaneously employed. The low swing gives firm control with great accuracy and speed of turning, and the advantage resulting from the use of small carriages is that more than one tool may be cutting at a time, the result obtained being greater output per man and per square foot of floor space occupied.

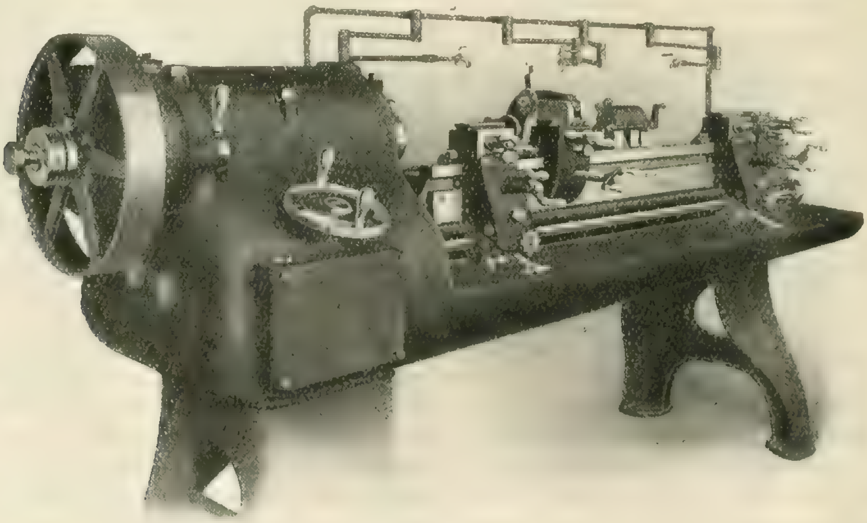
The cutting tool is a piece of high speed steel machined to fit closely a $\frac{5}{8}$-in. by $\frac{3}{4}$-in. hole in the tool holder. The cutting end projects just far enough beyond the tool holder to meet the requirements of the work. This cutter is caused to slide in and out of its holder by an adjusting screw conveniently operated by handle.

A convenient scheme is provided for quickly binding or releasing the tool holder so that the lathe hand may rapidly change from one tool holder to any other, either for sharpening purposes or to insert some other form of tool that may be required by the work.

The tool carriage differs so much from the standard form that the use of the same name seems misleading, but although the name carriage is used, it will be understood in this instance to mean practically a single block of metal fitted to slide on a rectangular guide rail, and to carry a casting tool as close to the guide rail as possible; the guiding rail and sliding block being so formed that the cutting strains are squarely borne by the guiding rail. The absolute firmness of a sliding block of this kind, in which the metal is subject to a compression strain only, will be readily understood.

In the Lo-swing two kinds of carriages are used. One is provided with gears for power feed, and the other is without power feed gears; both are provided with handles for traverse by hand; also a connecting bar by which the carriages without feed may be fed in connection with the power-feed carriages.

The advantage of the carriage is not only in its being lighter, more convenient and more stable, but



THE "LO-SWING" LATHE.

its width being only five inches instead of the usual two feet gives an opportunity to bring into simultaneous operation a number of tools on nearly all work over, say, eight inches long, the regular machine being furnished with four carriages tied together in pairs, two of which may feed in one direction, while the other two are feeding in the opposite direction, or all may travel in the same direction, and any or all may run back past the tailstock without moving the tailstock. The rolls used in both the follower and fixed rests are of large diameter, making the high speed practicable even on slender work. The main frame or bed of the machine is a single casting which forms the guide rail on which the carriages slide, the drainage pan for chips and oil, and the casing for enclosing spindle and gears.

The headstock is a part of the bed casting and is provided with the necessary gears for obtaining seven changes of speed. The gears and clutches for changing speed run in a shallow basin in which the lower edges are immersed in oil. The pulley for receiving a 3-in. belt is 18 in. in diameter, and runs at a constant speed of 560 revolutions. The spindle speeds range from 560 down to 50.

The proportions of gearing and all the running parts of the head have been made with special regard for the requirements of high speed steel. The spindle nose is very unlike the standard type. It only carries the centre point and a driver for the dog. The power feed for carriages is varied by hand-wheel on front of the head, any feed being instantly available.

The pump for oil for cutting tools is in the head end of the machine and gets its power from the main pulley, hence it does not require separate belt. It takes the oil from the reservoir under the head, and delivers it to the cutting tools, after which the oil flows back to the reservoir. The machine may be belted to a constant speed motor placed on the floor or to a countershaft overhead.

NEWS ITEMS.

The renovation and conversion of that part of the Royal Naval College at Portsmouth which is to form the new navigation school has been completed in time for the classes to join at the commencement of the new year.

A correspondent in the Times suggests an appeal to the Railway Commissioners with regard to overcrowding in the District Railway. He states that the carriages have 72 straps for the standing public to hold to and 48 seats.

The wrecking of overhead telegraph lines, such as sometimes occurs in severe storms will be rendered of small account between London and Glasgow, owing to the completion last week of the underground telegraph cable. A good deal of preliminary scientific work remains to be done however before the wires can be brought into actual operation.

The Board of Trade Inspection having been made it is hoped that the shallow underground tramway beneath Kingsway will be open for public traffic by the end of this month. The underground tramway will be operated in conjunction with the newly-electrified line from Southampton Row to the Angel at Islington. Leaving the subterranean terminus of the line, which is in Aldwych, the cars pass through a double tunnel laid under Kingsway and beneath Holborn, into Southampton Row. At the junction of Southampton Row and Theobald's Road the cars climb a stiff gradient leading to the street level, and thence they run as surface trams to the Angel.

In view of the electrification of the horse-tramway lines from Westminster Bridge and St. George's Circus to Wandsworth, the County Council have considered the question of the stability of the Albert Embankment and the roadway for a considerable distance south of Lambeth Palace, South Lambeth Road, and a body of workmen are now engaged in strengthening them. In that portion of the thoroughfare there are several water conduits, leading from the river, where barges are discharged, to manufactories, to which carts can pass at low water. Strong steel girders have been placed on the buttresses of the conduits, and coated with a thick layer of concrete. The stability of the thoroughfare, it is considered will not now be endangered by the extra pressure to which it will be subjected by the incessant heavy electric car traffic.

MOTOR NOTES.

FRENCH INDUSTRIAL VEHICLES.

A NOTEWORTHY feature is the manner in which the manufacture of vehicles for industrial purposes is extending in France. Not only have a considerable number of omnibuses and lorries been put upon the market, but the building of cars for industrial purposes has been taken up by some of the leading firms whose names have hitherto been associated only with pleasure vehicles. In the last few months too, it has been noticeable that the motor omnibus has commenced to come into use in Paris. The French capital is still behind London in this respect, but a number of motor 'buses are now running, and they are all of native manufacture. In this respect France is ahead of Great Britain. That is to say, although the total number of motor omnibuses in Paris is far below the number in use in London, the proportion of home-made machines is much greater. It is probably absolutely true to say, however, that all the big firms of motor manufacturers in this country have their hands quite full, and if the proportion of British-made motor omnibuses running in London is comparatively small, it is because the demand is quite beyond the possible output of home manufacturers. Moreover, it has to be borne in mind that the industry is still comparatively young, and that the number of engineering firms capable of undertaking such work, with satisfaction to themselves and their customers, is after all, comparatively small.

CARS FOR RAILWAY WORK,

Petrol motor-cars have latterly been successfully applied to railway work, and in this connection a car built by Messrs. Drewry and Sons, at the Herne Hill Motor Works, may be referred to. The car, which is constructed for a gauge of 3 ft. 6 in. is fitted with a vertical two-cylinder engine, giving 6 h.p. at 1,000 revolutions, and has two forward speeds and reverse, giving a maximum speed of 27 miles per hour.

There are two bevel pinions on the main driving shaft which run free, with a long gun-metal bearing in the tube encasing the shaft. The axle has a square in the centre, between the two bevel pinions, and placed freely on this is a square sleeve, fitting between the pinions freely, but with not end play. The axle itself has free end play in this sleeve, to enable side shock to be taken up without affecting the gear box. Fitted on the square sleeve is an ordinary dog clutch, actuated by means of a lever and spring rods from the driver's seat. The two bevel gears, being always in mesh with the bevel pinion at the end of the propeller shaft, revolve in opposite directions, and the car is driven ahead or astern as the dog clutch is engaged with one wheel or the other. In the central position both gears are out of action. The control levers for advancing the spark and working the throttle of the engines are fitted at each end of two hollow shafts running under the seat, and can be easily reached by the driver, whichever way he faces. The axles are fitted with ¾ in. side play at each end, a strong spiral buffer spring being interposed to keep the frame normally in a central position. These springs take up the side shock on curves and facing points.

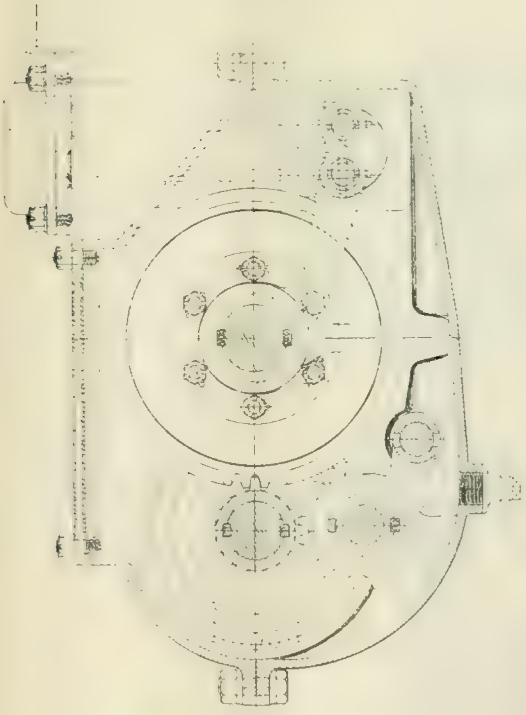
GOVERNING THE MOTOR.

The problem of perfectly governing an engine still remains to be solved. The governing of motors should be designed to give the utmost economy in fuel consumption. Throttling the cylinder charge necessarily lowers the compression, and when this difficulty is overcome by mixing the charge with a good quantity of air or retaining a portion of the exhaust gases, other difficulties arise. The dilution of the charge with air gives imperfect combustion which must continue so long as the compression space remains unalterable. By preventing the exhaust from opening, a method which was employed on nearly all the early types, the exhaust stroke becomes a compression stroke, and a considerable retarding action is put on the engine. This does not seem to be the ideal way of controlling a motor, and one can well understand how overheating used to take place. A better way is to vary the lift of the valve, which prevents the total discharge of the gases, and causes a smaller amount to be taken in as the fresh charge, and the next explosion is, therefore, not so powerful; but it has the great advantage of normal compression, and the full value is obtained from the charge.

24-30 H.P. ARROL-JOHNSTON CHASSIS.

The cars are built under the Arrol-Johnston patents, and are stated to be the result of a series of most exhaustive experiments.

The engine is of the four-cylinder vertical type, which runs at a normal speed of 950 revolutions per minute, and at this speed gives 24 h.p. on the brake. The cylinders are cast separately. The cylinder head and valve chest is not cast with the cylinder, but is attached thereto by six studs. The advantage gained by this is that should anything go wrong with any part of the cylinder, a complete new cylinder is not required but only a part. The material used in the construction of cylinders, pistons, and combustion chambers, is made from a hard, close-grained crucible cast-iron, which material should give long life and freedom from wear. The inlet valve is placed over the exhaust valve, thus allowing of a minimum wall surface to a maximum compression space, a great point in the economical running of a petrol engine, and one most usually ignored. Both inlet and exhaust valves are mechanically operated.



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SECTIONAL ELEVATION OF ARROL-JOHNSTON SPEED GEAR.

The crank-case is of a special alloy of aluminium. The crank-shaft is suspended to the top half by means of bearings, while the bottom half merely acts as an oil retainer, and to it is fixed the oil pump which is operated from the crank-shalt. This bottom half is readily removed by unscrewing a few bolts and without disturbing any other part of the engine. When removed, the whole mechanism of the engine is exposed to view, and the brasses, etc., can easily be repaired or renewed. The crank-shaft is machined from a solid forging of specially selected nickel steel. All the main bearings are ground. The cam-shaft is made from a solid piece of tool steel, the cams being carefully cut by special machinery. The cam-shaft, cam casing, valve-lifters, and their guides are all in one piece, and can be removed from the crank-casing without disturbing other parts of the engine. The cam-casing forms its own oil reservoir for lubricating the moving parts. On the cam-shaft there are only two sets of cams to each cylinder, one operating the exhaust and the other operating the inlet and ignition. A saving in the number of parts in the engine is the result.

NEW FEATURES DESCRIBED.

The governor is a patented type, and is adjustable at will. It is operated by the varying suction caused by the engine, the speed being capable of variation from 200 to 1,200 revolutions per minute.

The car is fitted with four speeds forward and one reverse. The gear-box is suspended by a swivelling three-point support, which does away with all strains due to twisting of the frame on rough roads. The gear-wheels run in an oil-tight gear-case.

The lubrication of the gear-case shafts is automatic, the law of capillarity being adapted to the purpose. A well is made in each end of the gear-box casing with ducts leading to each bearing, these wells and ducts being connected by woollen strands, so that the bearing has a constant supply of clean oil and a supply which does not run short as long as there is oil in the gear-box. A special universal joint is fitted and is so designed that all driving efforts act in one plane, giving a constant speed to the cardan shaft.

To the rear end of the cardan shaft is fitted a patented combined spring and universal joint drive, claimed to be absolutely reliable. The front axle is made of heavy H section, in order to keep the stresses due to the overhanging of the journal as small as possible by reducing the horizontal distance from the tread of the wheel to the centre of the swivel pin.

The hind axle is of the live type, and in the event of its breaking, no damage is done to the car as it is still supported by an outer steel casing, and the wheels cannot come off.

There is no fan behind the radiator, but fan blades are inserted in the flywheel, which act as a fan. This method probably absorbs less power than the usual fan, and is not liable to get out of order.

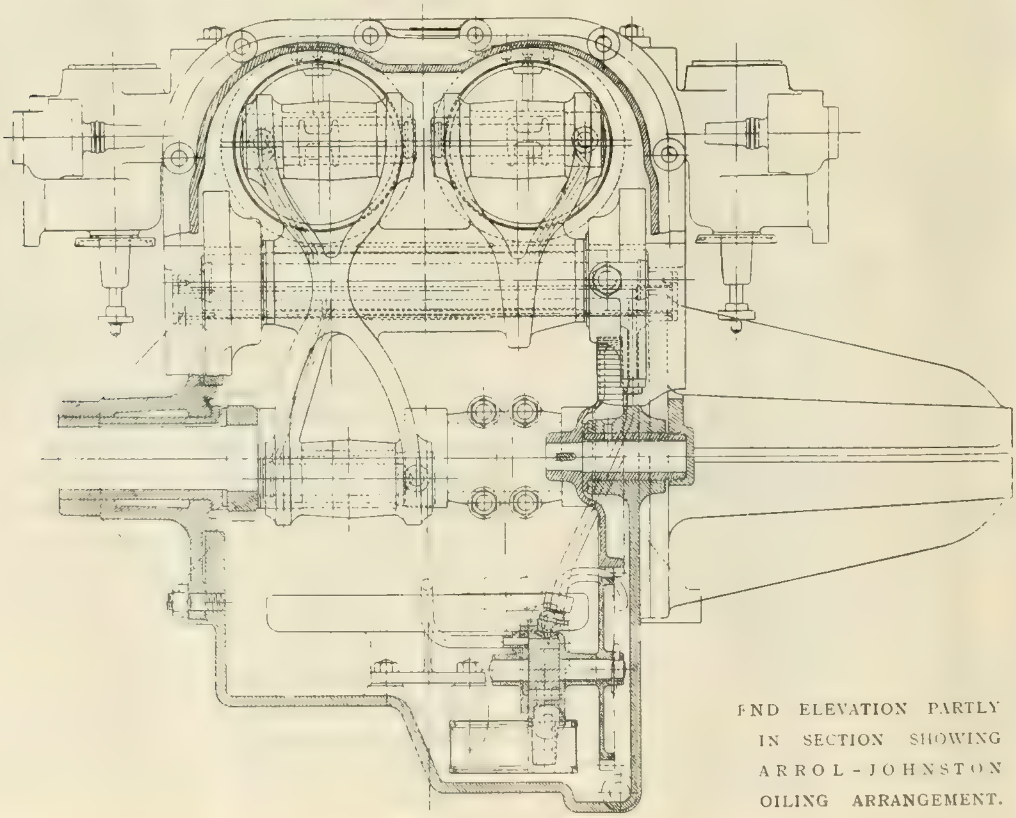
The exhaust silencer is made from sheet steel with special nozzles and baffle plates, and is of such size as to prevent back pressure. It has been designed with the view of increasing the power of the engine, instead of decreasing it.

WOLSELEY TOOL AND MOTOR COMPANY.

This company, with its own stand at the Paris Salon, had a very comprehensive exhibit, including a 32-h.p. touring car, 25-h.p. chassis, fitted with four-cylinder vertical engine, 18-h.p. Siddeley car with four-cylinder vertical motor, 18-h.p. Siddeley chassis, showing details of construction, 12-h.p. car, 5-h.p. chassis, 106-h.p. launch engine and a showcase of Vickers' steel parts.

Both the 25 and 32-h.p. types have been produced to meet the demand for high-powered touring cars and in their construction and mechanism the latest practice in motor engineering has been embodied. The chief points to be noticed are the separately-cast cylinders and the double ignition system which employs either a low-tension magneto or the usual high-tension ignition. The gear-box is in two parts, thus permitting for different lengths of wheel bases without undue complication. Good control is obtained by variable lift mechanism acting on the inlet valves. The highest quality Vickers' steel is used wherever possible in the construction.

The ignition on the 15 and 18-h.p. cars is duplicated, and arranged on an entirely new method. The principal system is the high-tension Simms Bosch magneto, having a separate distributor which is arranged as part of the motor mechanism, the contact-breaker being enclosed with the magneto. In this manner what has hitherto been a trouble with the high-tension magneto is avoided, while at the same time the advantages gained should be absolute synchronisation and a hotter spark, giving complete combustion of the explosive charge. A reserve system is also fitted and connected up so that by means of a specially designed switch it can be utilised with the same contact-breaker and distributor and wiring system is connection with an accumulator and trembler coil.



END ELEVATION PARTLY IN SECTION SHOWING ARROL-JOHNSTON OILING ARRANGEMENT.

THE CARNEGIE ENGINEERING BUILDING.

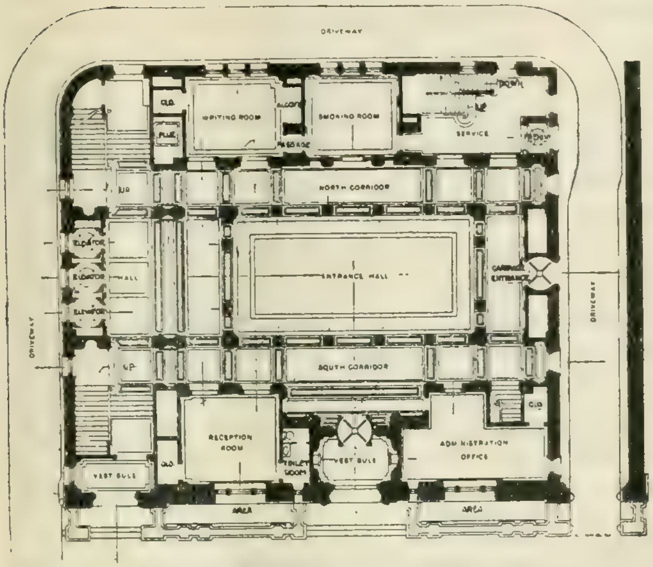


FIG. 1. PLAN OF ENTRANCE ON FIRST FLOOR.

CONSIDERABLE interest centres in the new engineering building which, thanks to the munificence of Mr. Carnegie, is to provide a common home for the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the Engineers' Club. The original intention was to have made the scheme even more comprehensive than this but the American Society of Civil Engineers decided not to participate in the benefits of the proposed gift. Office accommodation is, however, to be found for many American societies having engineering or scientific interests. The public competition initiated by the joint committee for the selection of architect has resulted in the choice of the plans illustrated in this issue, for which we are indebted to the Iron Trade Review.

SOME STRUCTURAL DETAILS

The frontage of the building on Thirty-ninth Street covers two city blocks and is 125 ft. front and [illegible] ft. deep. The building had to meet specified requirements in several directions. It had, first, to serve the convenience of each of the individual societies who are the founders, and fig. 1 shows to some extent how this has been accomplished. The building had also to provide for the three national founder societies and other organisations, meeting rooms and auditoriums. The chief of these, to be situated on the third floor, which is shown in fig. 2, is designed to accommodate 1,000 persons, and the seats are arranged on a grade conforming with modern theatre practice. On the floor above the large auditorium will be two assembly rooms, occupying the principal portion of the area which may be used either independently or in common. Auxiliary smaller rooms are also provided on this floor. As it is expected there will be a great demand for small meeting rooms, a number of small lecture halls will be provided on the third floor. The two upper floors are to be devoted to the library requirements of the various societies. The intention in bringing the libraries together is to create a working and reference library of the highest possible value and completeness as regards engineering science and practice.

In this respect, says the report of the special committee from which we quote these particulars, the societies have recognised that there is before them an unexampled opportunity, and if the co-operation of the New York Public Library on the adjoining block can be secured, this engineering library will be certainly the most important in America. The contract for construction was signed in July last, and the time limit is fifteen months, so that by the autumn of the present year the building should be completed.

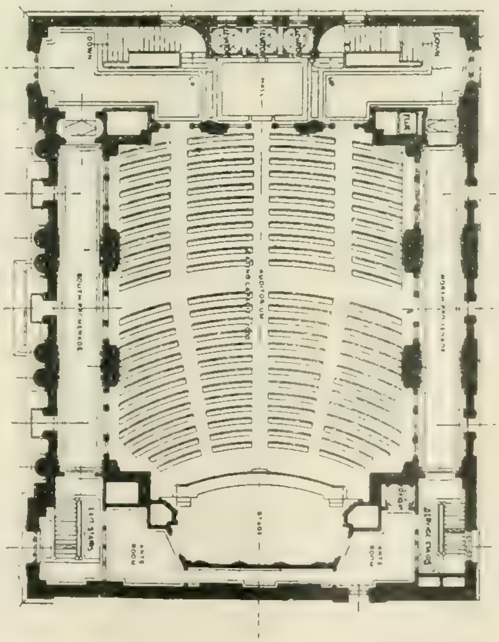


FIG. 2. PLAN OF AUDITORIUM ON THIRD FLOOR

AN ELECTRIC ACCELEROMETER.

BY R. B. OWENS, M.CAN.SOC.C.E.

THE advent of the electric motor as a competitor of the steam engine, especially in the traction field, has given rise to certain acceleration problems unfamiliar to engineers of a generation ago. At a time when the train mile was a satisfactory unit in which to reckon haulage costs, there was little occasion to bother with acceleration. Now, however, when neither the train mile, car mile, nor ton mile suffice, even when coupled with a speed factor as a basis of estimation and analysis, now when to maintain certain schedules more energy is expended in accelerating than in overcoming frictional and grade resistances, a simple, accurate, and reliable means of measuring acceleration is urgently demanded—a means at least comparable in simplicity and accuracy to those employed in the measuring of the quantities of which it is the second and first differential with respect to time. The measurement of length is familiar to all. Of practical methods of measuring velocity or speed, at least of machines, one of the most satisfactory, if not the most satisfactory, involves the use of a suitable constantly excited or permanent magnet dynamo mechanically driven by the piece whose velocity is to be measured, and electrically connected through an ammeter to a circuit of constant co-officients as shown in fig. 1.

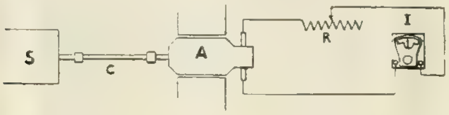


FIG. 1.

S is the shaft whose velocity is to be measured. C is a mechanical coupler. A is the armature of a small permanent magnet or constantly excited continuous-current dynamo wound so as to have a negligible reaction within the limits of its use. R is a variable non-inductive resistance, and I is a zero centre d. c. ammeter. The reading of I will be proportional to the speed of S, and by adjusting R can be calibrated in the revolution per minute, feet per second, or miles per hour as desired. As the current through I is proportional to speed, it is only necessary to determine the rate at which the current varies in order to have a measure of acceleration. This is simply and easily done by inserting in the circuit with I a transformer T, with its secondary connected, for purposes of adjustment, through a non inductive resistance R_1, to a zero centre d. c. voltmeter V (see fig. 2). The reading of the voltmeter V will then be proportional to the acceleration, positive or negative, of the shaft S.

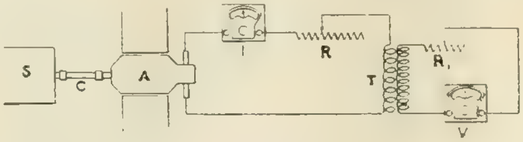


FIG. 2.

Substituting recording instruments for the indicating ones shown, we have a recording speed indicator and a recording accelerometer. The transformer must have a straight line saturation curve and a large transformation ratio as the secondary induced voltage is necessarily small, and the voltmeter V must also be sensitive. The calibration of the ammeter as a speed indicator is effected by driving the armature A at different constant speeds, as shown by ammeter reading, and taking the revolutions in given time by means of a revolution counter and stopwatch. The calibration of the voltmeter as an accelerometer is best done by driving the armature A by a separately and constantly excited motor having applied to its armature, preferably of small momentum, a voltage varying approximately as a linear function of time. With proper manipulation of apparatus the ammeter readings plotted against time will be a straight line whose slope will be constant and equal to the acceleration and to the constant reading of the voltmeter to within a constant.

In some tests made in the writer's laboratory not long ago, A (see fig. 2) was the armature of a small low voltage separately excited d. c. generator; S the shaft of a 3-h.p., separately excited d. c. motor, to whose armature by a potentiometer arrangement a steadily increasing or decreasing voltage could be applied; I and V Weston ammeter and milivoltmeter and T a small lighting transformer with a transformation ratio of 20. Excellent results were obtained, speed and acceleration being read to exactly the same degree of accuracy that Weston d. c. ammeters and voltmeters are capable of. With recording instruments substituted, this would seem to meet every requirement of a practical apparatus for the management and recording of velocity and acceleration in railway work, both steam and electric, and is applicable, of course, in many other connections.

Read before the Electrical Section of the Canadian Society of Civil Engineers.

STRUCTURAL STEEL DAMS.

By F. H. Bainbridge, Principal Assistant Engineer, C. and N. W. Railway.

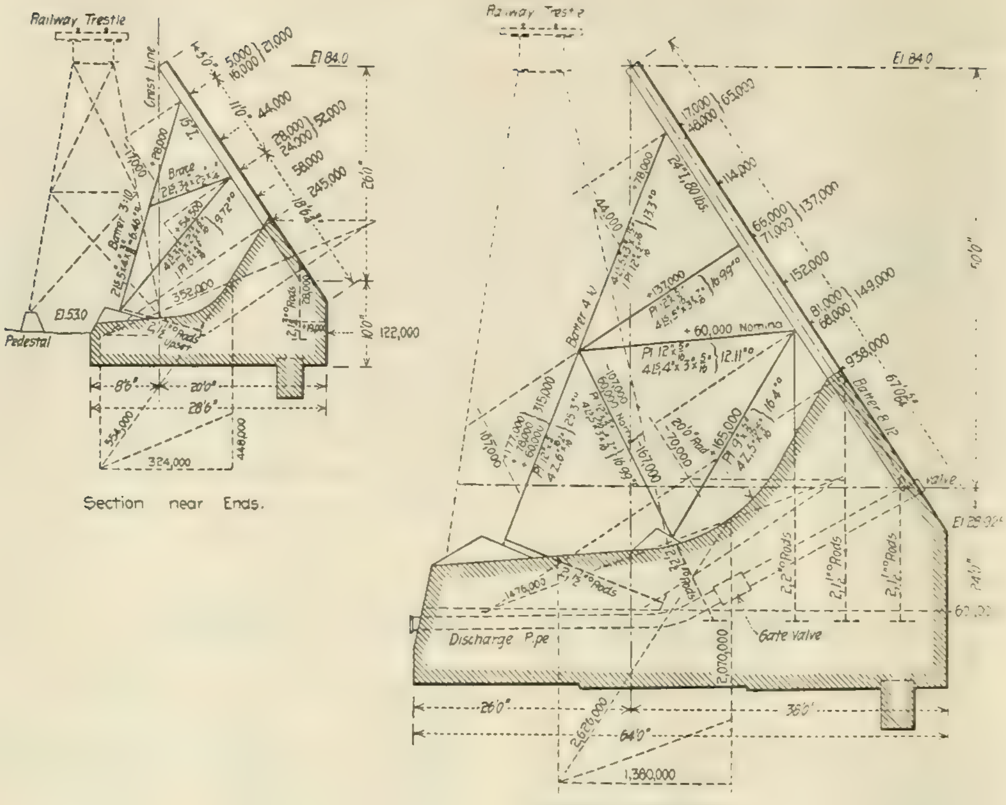
THE writer first became interested in the subject of "Steel Dams" in 1893, making in that year for his own information estimates on a great number of different types of structures. The subject had previously been considered to a limited exetnt both in Europe and in America.

In 1894, structural steel was as low as one cent per pound (Pittsburg), and the finished material correspondingly low. At the present time prices for structural material at Pittsburg are about three-fourths greater. On the other hand, in 1894, Portland cement cost about three times what it does at present. Had the relative values of steel and Portland cement in 1894 been maintained, the subject of steel dams would have received far greater attention than has been the case. Notwithstanding the adverse trend in prices there will still be found to be great economy in the case of steel for dams in many locations.

It is usually assumed by the uninformed that stone structures subject to the action of air, water, and frost will last indefinitely. As a matter of fact only a small percentage of the stone which is accessible is at all fit for use in structures, and even in the best quarries, the inferior stone which must be wasted or used for rip-rap, often amounts to 50 or a greater percentage of the stone quarried. In a dam, especially in cold climates, stone is subjected to most trying conditions and untried local stone should be used only with the greatest caution.

So far as our present experience goes Portland cement-concrete for dams appears to be a safer material, but it must be remembered that concrete setting in air, contracts in volume, and in large masses cracks are almost certain to result. For this reason concrete for large dams must first be cast in blocks and set in mortar joints after being dried out. Under certain conditions reinforced concrete for high dams appears to be a promising material, especially where an arched form is permissible, and its first use in this direction will be awaited with considerable interest. I am aware that a number of low dams have been built of reinforced concrete, but as qusetions of economy limit the use of steel to high dams, such only will be here considered.

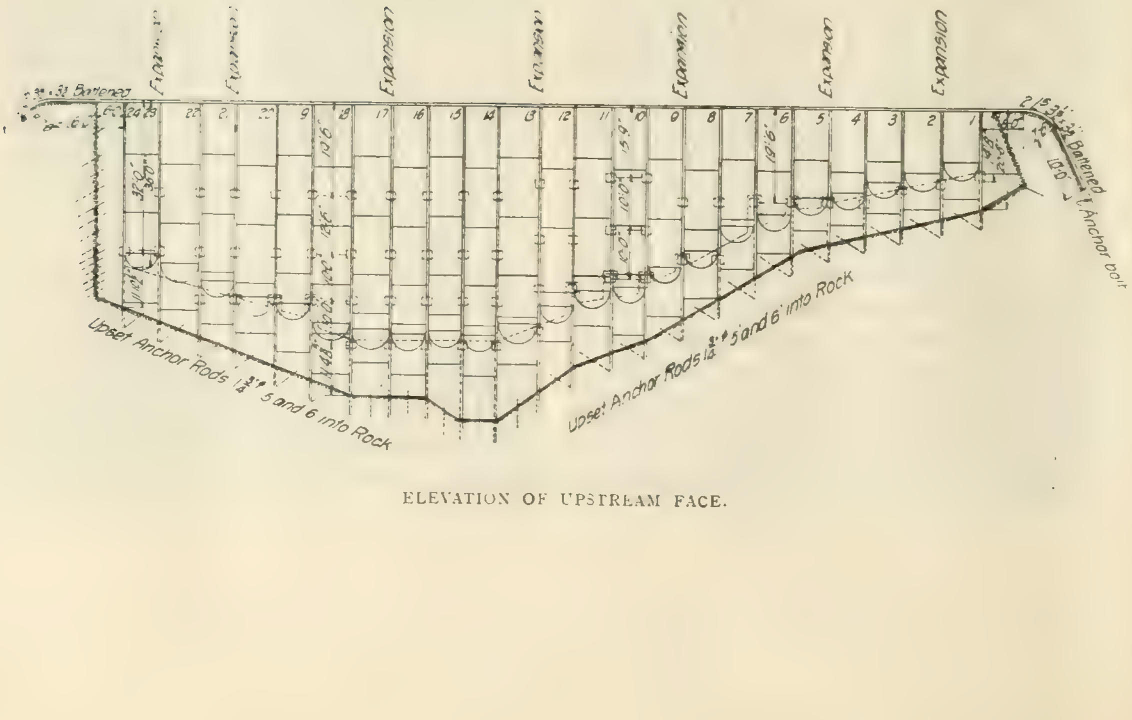
While stone work, in common acceptance, has an undeserved reputation for permanence and stability, steel has an equally undeserved reputation for deterioration. The reason for this is plain. Opportunities for observing the weathering of steel are most frequent in large cities where the air is laden with sulphuric and carbonic acid gases. Iron, water, rust, is usually looked upon as a necessary sequence but



Section near Ends.

Section near Centre

CROSS SECTIONS OF STEEL DAM.



ELEVATION OF UPSTREAM FACE.

my own observation on stand pipes and dams built of steel is, that reasonably pure water alone has little effect in corroding steel, and that under water, a good paint is a first class protection.

STEEL DAM AT ASH FORK.

The steel dam as Ash Fork, Arizona, was completed in February, 1898. The elevation of upstream face is shown on opposite page. Above are cross-sections of the Redridge dam. The steelwork at Ash Fork received one coat of raw linseed oil in the shop and one coat of red lead and an additional coat of graphite paint after erection. When visited by the writer in the fall of 1902 it showed no evidence of rust either on the water face or on the back. The writer understands that it will be repainted for the first time since 1898 during the current year. So far as is known to the writer the steel dam at Ash Fork, Arizona, was the first fixed metallic dam ever constructed. All stresses and pressure are carried by the steel frame, concrete only being used to seal the toe at the meeting point of the steel face with the bed rock and to level off the bed rock for a footing for the columns.

The Ash Fork dam is situated four miles east of Ash Fork, a station on the Atchison, Topeka and Santa Fe Railway. It is located in what is known as Johnson's Canyon, ordinarily a dry canyon with water running at only two periods of the year, from February to May, and at times only, in July and August. This reservoir was built by the Atchison, Topeka and Santa Fe Railway Company for the purpose of supplying water service for engines and the station and village of Ash Fork. Previous to the establishment of the reservoir, water was supplied in tank cars from Williams, 27 miles distant, or from Bellemont, 45 miles distant. The average consumption at the time of construction was about 90,000 gallons per day. The reservoir has a capacity of 36,000,000 gallons. Evaporation amounts to about nine feet per year.

The steel portion of the dam is 184 ft. long on top and the whole dam is about 300 ft. in length, including short masonry abutments at each end. Structurally it consists of a series of triangular steel bents resting on concrete foundations and carrying steel face plates on the inclined or upstream end. At the dam site there is an exposure of extremely hard igneous rock, except on the west side, where the same character of rock is covered with soil varying from a few inches to three or four feet in depth. Natural cinder pockets were uncovered at the site of the west abutment and under the crest of the dam between bents 16 and 20. Along the whole length of the water toe the rock was continuous but badly broken by seams, while between bents 14 and 15 was a hole which had originally been a cinder pocket, but which when uncovered was found to be filled with boulders.

These boulders were partly removed and the hole filled in with concrete. Elsewhere along the water toe the rock was generally removed to a depth of two feet, but to a greater depth where the rock was especially loose and seamy. The outlet is a 6-in. pipe bedded in concrete in a trench excavated in the rock under the dam. From the down stream end of this pipe a 4-in. pipe line extends to Ash Fork, four miles distant.

No spillway or waste weir is provided, the dam being designed to permit a flow of six feet depth of water over the crest. Since its construction a maximum flow of 4 ft. has been observed. To prevent the overflow from undermining the foundation, loose rock is piled at the base to break the force of the falling water. However, overflow to any considerable extent is a matter of rare occurrence.

DETAILS OF BENTS.

The dam consists of a series of 24 triangular bents. These bents are right-angled triangles, with the inclined side, having a slope of 45 deg., facing upstream, and the rock bottom of the canyon forming the base. The dimensions of the bents vary with their height. The end bents (Nos. 1 to 7 and No. 24) are 12 ft. to 21 ft. in height each, consisting of a vertical Z-bar column and an inclined I-beam. Bents Nos. 8, 9, 22 and 23 are about 33 ft. high; each has a vertical Z-bar column, and inclined I-beam and two inclined posts built up of Z-bars, the upper of these resting on the same bed plate as the vertical post.

Bents. Nos. 10, 11, 12, 19, 20 and 21 are 33 ft. to 41 ft. 10 in. high. These have but one inclined post, which rests on the same bed as the vertical post, while above it are truss members connecting the face members with the posts. Bents Nos. 13 to 18 inclusive are 36 ft. to 41 ft. 10 in. high, and have two inclined posts with truss members above the upper post. The general designs of these four styles of bents are shown on page 35.

In all of these the face is composed of a [illegible]-in. 65 lb. I-beam, reinforced on the under side with a plate ½ in. thick and 18 in. wide. The vertical and inclined posts are all composed of 4 Z-bars and a web plate. The details of bent No. 15 are shown on page 34. The bents are connected by a system of transverse diagonal bracing in alternate panels, as shown on page 35.

The structure is composed of alternate rigid and loose panels. The crest or apron plates which fit the braced panels between the bents are riveted to a curved angle which is riveted to the upper end of the curved plate, while in the unbraced panel this angle merely bears on the apron plate. By this means the forces which would result from longitudina expansion and contraction and which would be fatal to the structure, are avoided.

An elevation of the dam on its upstream side is shown on page 32. The face is composed of steel plates ⅜ in. thick and 8 ft. 10½ in. wide, riveted to the outer flanges of the I-beams of the bents. The plates are mainly 8 ft. in length. They are curved to a radius of 7 ft. 6 in., forming a series of gullies or channels down the face, leaving a flat portion which rests on and is riveted to the I-beams.

The curved plates, however, do not extend into the concrete of the toe, but are replaced by flat plates in the bottom course, the bottom curved plate being dished to a radius of 3 ft. 8½ in., forming a segment of a sphere. The edges of all face plates and their splices were planed to a bevel edge for calking.

At each end of the dam is a masonry abutment with a water face of the same slope as the steel face plates. The steelwork is anchored into these abutments by two angle sheets as shown on the following page.

The frame work of the bents was first erected completely, only such face plates being bolted on as were necessary to properly space the bents. The various members were blocked up in position in such a way as to allow free access for imbedding their ends in concrete where required and for drilling the holes for the anchor bolts.

When the frame work was erected and the anchor bolts set, the face plates were riveted on except the lowest course in the five highest panels, which were

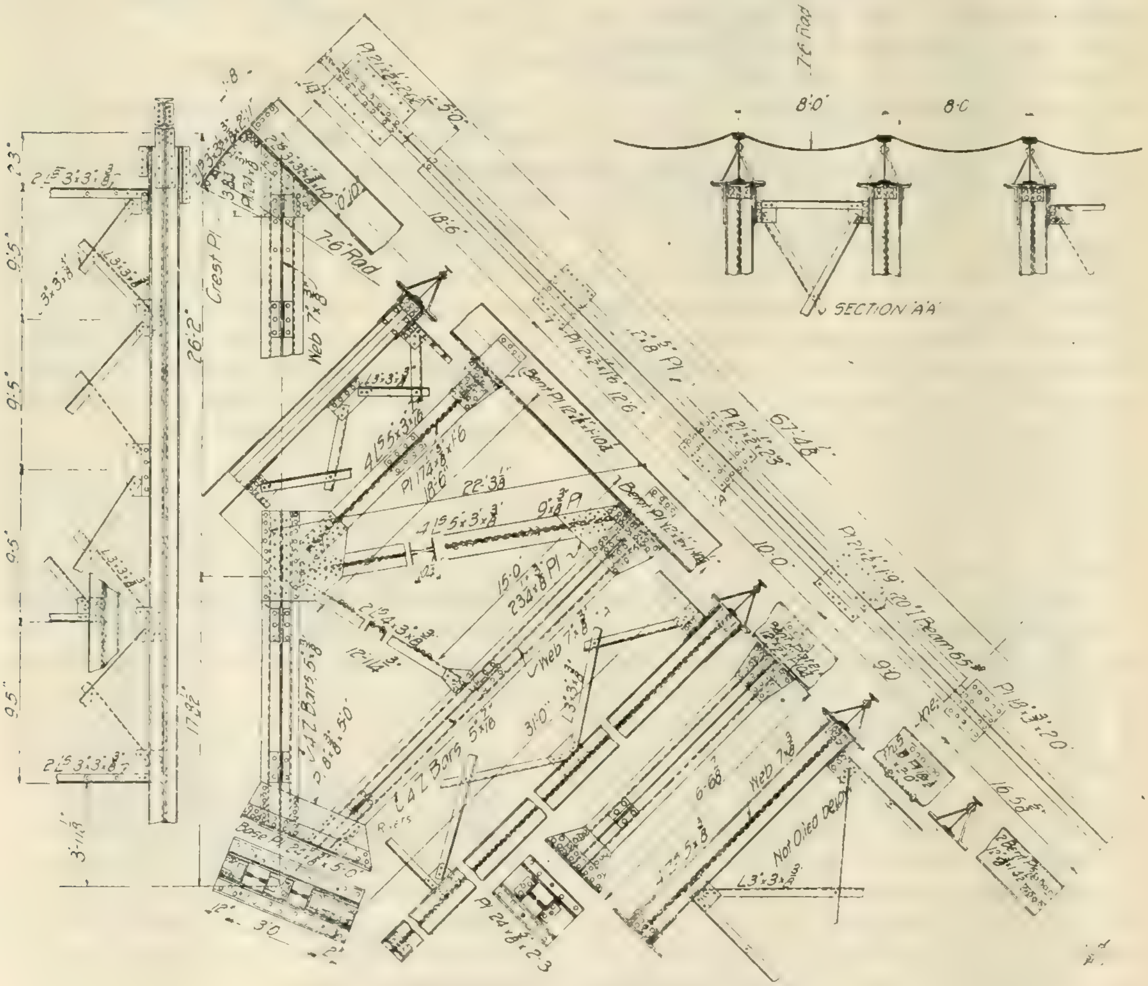
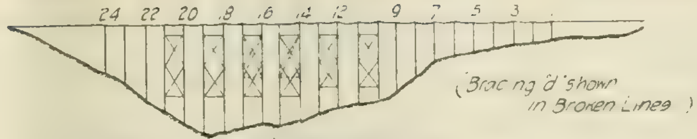
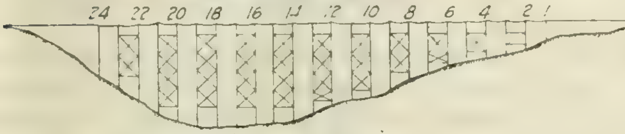


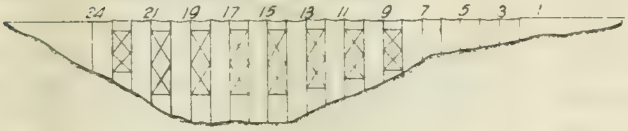
FIG. 3. DETAILS OF BENT NO. 15.—ASH FORK DAM.



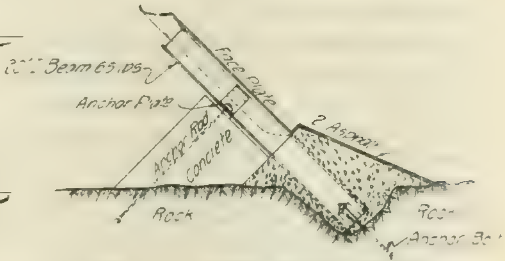
Section showing Inclined Bracing 'b' and 'd'



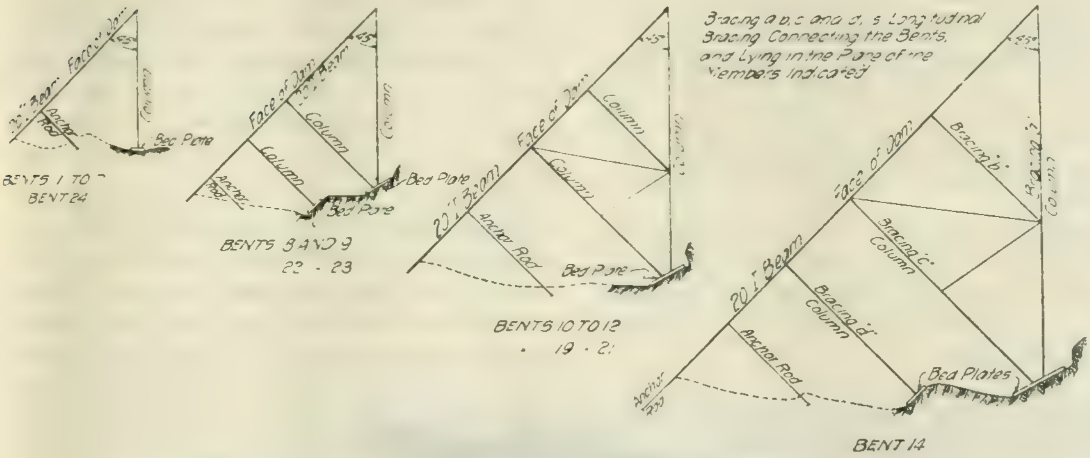
Section showing Vertical Bracing 'a'



Section Showing Inclined Bracing 'c'



DETAILS OF TOE, SHOWING CONCRETE JUNCTION TO BED ROCK



DIAGRAMS SHOWING LATERAL BRACING AND FRAMED BENTS SUPPORTING UPSTREAM FACE.

left open to provide a waterway until the rest of the structure was calked and painted. The remaining plates were then put in place and riveted and calked as rapidly as possible.

When the reservoir filled the steel structure was found to be absolutely watertight, but some leaks developed in the concrete toe. In 1900 this concrete was covered with asphalte, as shown above, and at the present time the entire structure is said to be absolutely watertight.

The structure was designed by the writer in collaboration with Mr. James Dun, chief engineer, and Mr. A. F. Robinson, Bridge Engineer, of the Santa Fe system, Mr. W. D. Nicholson was resident engineer in charge of the work in the field.

STEEL DAM AT REDRIDGE.

The steel dam with concrete foundations at Redridge, Mich., was completed in the fall of 1901, and has since given satisfactory service. It is the joint property of the Atlantic Mining Company and the Baltic Mining Company, and the reservoir formed by it supplies water to the stamp mills of both these companies.

It differs from the Ash Fork dam in that the weight of a concrete base furnishes the resistance to overturning and sliding, in place of anchorage to the bed rock as in the Ash Fork dam.

This structure was proposed and designed by Mr. J. F. Jackson, M.W.S.E., who also had charge of the erection of the steel work of Ash Fork dam.

Below is shown a view of the face of the dam during construction.

The concrete base is founded on rock for its entire length, except under part of one core-wall where an impervious clay was encountered. The upper diagrams on page 32 show cross-sections of this base at two parts of the structure.

The steel portion of the dam is 464 ft. long on the crest, and consists of a series of steel bents, 8 ft. apart to which is riveted a facing of steel plates. Typical cross sections at the highest and lowest points are illustrated. The face member is an I-beam (15 in. in the smallest bents and 24 in. in the others). Riveted between the bents are ⅜ in. curved face plates, concave to the water, 7 ft. 5½ in. wide over the chord, and having on each side a flat strip 5⅞ in. wide, which is riveted to the flange of the I-beams. The radius of the curve is 7 ft. 5 7/16 in., and the plates are 16 ft. long.

Below the bottom course of curved plates is a course of flat plates, and the open space thus left is closed by an inclined diaphragm. The vertical joints are double riveted, the face plates lapping each other on the I-beams. Rivets are ¾ in. diameter, 2½ in. pitch. The iron work is continued down the vertical face of the base with a 3/16 in. plate. All joints on the face are caulked.

Before and after erection the ⅜ in. face plates were given one coat of Edward Smith and Co.'s durable metal coating, and the 3/16 in. facing plates, two coats after erection. All other parts of the structure were painted with graphite paint.

This dam is not arranged to act as a weir, but a spillway with removable flash boards was provided at the west side of the reservoir.

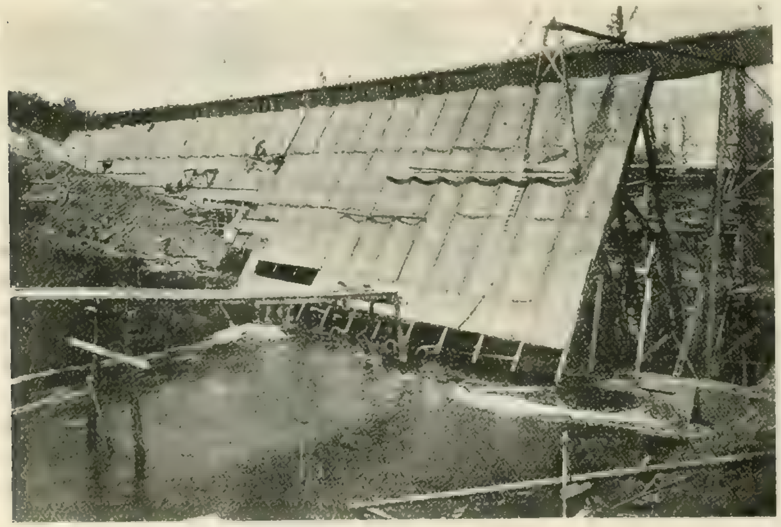
As a study in economy in design and to show that this type of steel dam construction can be carried to much greater heights than has yet been done, the writer has prepared designs for a single section 100 ft. high.

In the design of the Ash Fork dam the writer, complying with the wishes of the Railroad Company's engineers used low unit stresses and the minimum thickness of material was limited to ⅜ in. In the typical design referred to a minimum limit of ¼ in. thickness for material is used, and unit stresses are proposed corresponding with the general practice in stand pipe and tank construction, a class of structures to which steel dams bear a close relation.

In the 42 ft. high bents of the Ash Fork Dam, the average weight of metal per square foot of cross section was in the face plates and beams 50 lb. per square foot, and in the struts and bracing 37 lb. per square foot. Considerations of economy alone would in this case call for a steeper inclination to the face plates, but to reduce the required anchorage force to what was deemed safe in seamy rock, an inclination of 45 deg. for the face was used.

In the typical design of a 100 ft. high bent, the estimated weight of face plate and beams is 47 lb. per square foot of cross section and of struts and bracing, 79 lb. For lower bents the weight for the face plates and beams per square foot will decrease very little, while the weight of the struts and bracing will decrease fast. Also, from general considerations as the inclination of the face plates is reduced below 45 deg. the weight of the face plates and beams increasing faster than cosecant of the angles, will increase very fast, and the weight of the struts will also increase. From the above reasoning it is concluded that the angle of face plates with the horizontal should not be less than 45 deg.

Where the crest of the dam is not intended to be used as a weir the type of bent adopted in the Redridge dam will be found to be economical in weight. In designing the frame it is entirely possible to construct



REDRIDGE DAM UNDER CONSTRUCTION.

it so that the stresses produced by the water pressure will run back and forth through the frame, making a frame uneconomical in skeleton and producing a reduplication of joints expensive both in labour and material.

A good rule to follow in designating the frame is: "Carry the pressure on the beams to the foundation in the most direct manner possible." The method of stress lengths proposed by Carl Bender, C.E., in studying economy in bridge design, is also equally well adapted to the study of frames for steel dams.

UNIT STRESSES.

The writer recommends the following unit stresses, these being in accordance with the general practice in designing water tanks, standpipes, and similar structures.

Steel in tension, 20,000 lb. per square inch.

Steel in compression, 20,000 lb. per square inch, reduced by the following formula in which P equals the permissible stress, L the unsupported length of column in inches, r the radius of gyration in inches.

$$P = \frac{20{,}000}{1 + \frac{L^2}{13{,}500\,r^2}}$$

No compression member should have a length exceeding 120 times its least radius of gyration. The specification for compression members has been purposely made severe on account of the vibration liable to result from overflow.

The shearing strain on rivets should not exceed 15,000 lb. per square inch and the pressure upon the bearing surface of the projected semi-intrados of the rivet should not exceed 27,000 lb. per square inch.

In field riveting the number of rivets required should be increased 25 per cent.

The same unit stresses may be used for stresses resulting from water pressure and from dead load.

Part of the face plates may be considered as reinforcing the top flange of the beams, but in making such allowance it must be remembered that where two stresses at right angles to each other exist in one member, the maximum induced stress equals the square root of the sum of the squares of the two direct stresses.

The distance from the centre of the rivet to the edge of any plate should be not less than one and three-quarters the diameter of the rivet.

In calculating the net section of tension members the diameter of the rivet should be increased by $\frac{1}{8}$ in.

To insure effective caulking the pitch of rivets along the caulked edge should not exceed the following:

For $\frac{5}{8}$ in. rivets $2\frac{1}{4}$ in. pitch.
For $\frac{3}{4}$ in. rivets $2\frac{3}{4}$ in. pitch.
For $\frac{7}{8}$ in. rivets 3 in. pitch.

Or, governed by the thickness of the plate, the following:

For $\frac{1}{4}$ in. plate $2\frac{1}{2}$ in.
For $\frac{5}{16}$ in. plate $2\frac{5}{8}$ in.
For $\frac{3}{8}$ in. plate $2\frac{3}{4}$ in.
For $\frac{1}{2}$ in. plate 3 in.

It will seldom be found necessary to use face plates over one half inch in thickness.

From a paper read before the Western Society of Engineers.

THE FUTURE OF THE WELSH COAL FIELDS.

"The Welsh Coal Fields" is the title given to a series of informing articles reprinted from the Syren and Shipping, with an exhaustive introduction by Sir Charles M'Laren, Bart., M.P. It is pointed out that, "as compared with other colliery districts, South Wales has peculiar advantages over every rival in the extent and the quality of its supplies, in the facilities for prompt and cheap shipment which it enjoys, and in the reputation it has acquired in foreign markets This reputation amounts to a "good-will" of very great value to the trade, and is still a powerful weapon in the hands of the coal owner against the persistent pressure of German competition. But too much reliance must not be placed on this alone. Nor will it be enough to repeal the coal tax, and by depriving our foreign rivals of the direct bounty of a shilling a ton which this amazing fiscal absurdity has bestowed upon them, restore to the British merchant the conditions of a fair field and no favour which he once enjoyed. South Wales will still remain handicapped by her high working costs as compared with other coal-producing areas; and it ought to be the duty, as it is the interest, of both men and masters to reduce these costs." The publication is admirably illustrated.

At a meeting of the Underground Electric Railways' Company of London held on Wednesday, Mr. Edgar Speyer was elected Chairman of the Company in succession to the late Mr. C. T. Yerkes. Sir George Gibb, late General Manager of the North Eastern Railway, succeeds Mr. Yerkes as Chairman and Managing Director of the Metropolitan District Railway Company. Sir George has also been elected Deputy Chairman and Managing Director of the Underground Company.

THE ALLIS-CHALMERS STEAM TURBINE.

THE recent starting up of a steam turbine at the Washington Street power house of the Utica Gas and Electric Company, Utica, New York, calls attention to the fact that this is the first turbine to be put into operation by the Allis-Chalmers Company, who have recently entered the steam turbine field. The turbine outfit installed at Utica is shown in the accompanying illustration (fig. 1.)

This turbine is rated at 1,500 kilowatts normal load, and runs at a speed of 1,800 revolutions per minute. It is direct coupled to an Allis-Chalmers two-phase, 60-cycle revolving field alternator, operating at 2,500 volts. The unit has a continuous overload capacity of 25 per cent., with a three-hour 50 per cent. overload capacity, without exceeding a safe generator temperature, and capable of a 100 per cent. safe momentary overload. Artificial ventilation by means of an electrically-driven blower will, however, enable the unit to be run safely beyond its rated overload capacity.

The turbine follows the well-known Parson's type which has proved itself eminently successful in numerous installations both here and abroad. The Allis-Chalmers construction, however, embodies a number of features which are claimed by the builders to be distinct improvements.

BLADE CONSTRUCTION.

The chief distinguishing feature of this construction is the blading, which, while it is of the Parsons' reaction type, as regards the principle of operation, differs in mechanical construction in a number of essential details.

The roots of the blades are formed in dovetail shape by special machinery, and are inserted in slots cut in foundation or base rings ; these slots being formed by special machine tools in such a way as to exactly conform to the shapes of the blade roots. The foundation rings them-

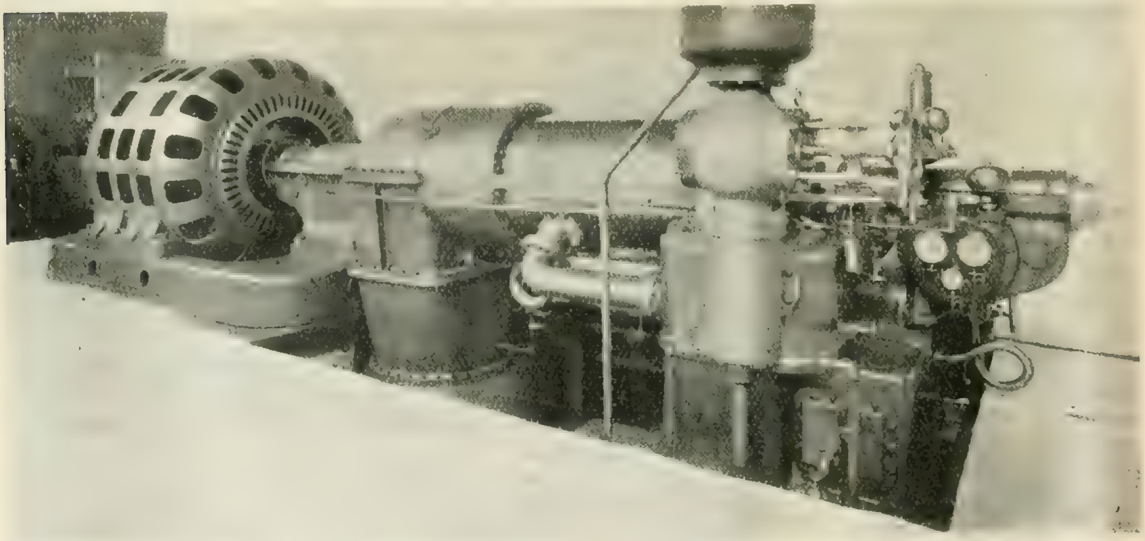


FIG. 1. TURBO-GENERATOR AT THE WASHINGTON STREET POWER-HOUSE OF THE UTICA GAS AND ELECTRIC COMPANY.

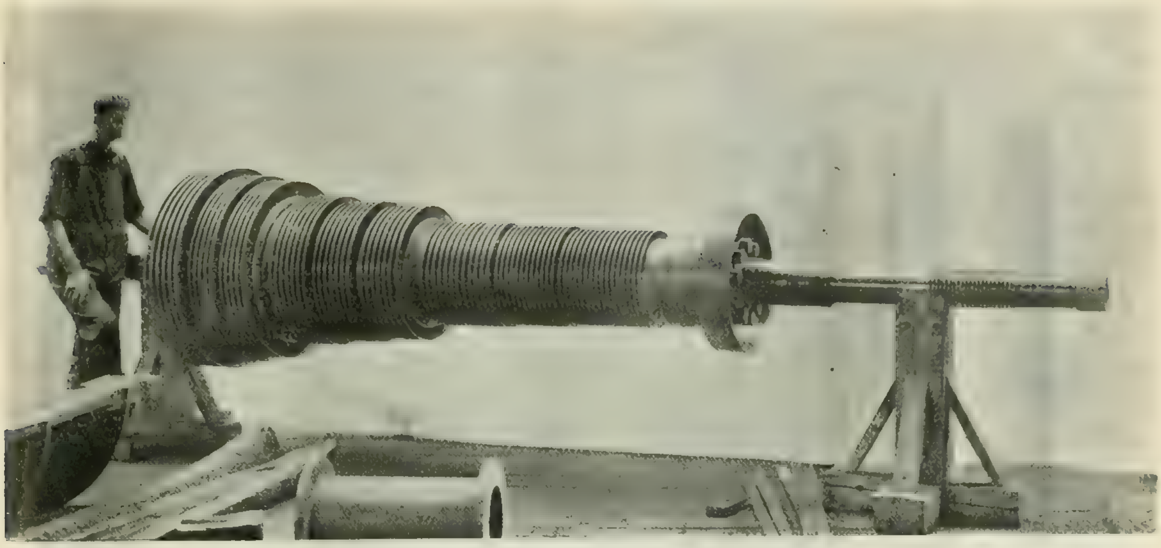


FIG. 5. SPINDLE OF THE ALLIS-CHALMERS TURBINE.

selves are of dovetail shape in cross section, and are inserted in dovetailed grooves cut in the turbine cylinder and spindle respectively, in which they are firmly held by key pieces, much in the same way that the well known " Lewis bolt is fastened. In order to further ensure the integrity of the construction, the key pieces or rings after being driven into place are upset into undercut grooves.

Another noticeable feature of the blading is the method of reinforcing and protecting the tips of the blades. This point in steam turbine design is one upon which much thought has been expended by various inventors, and the Allis-Chalmers Company claim that the construction employed by them successfully solves all difficulties. In forming the blades a shouldered projection is left at the tip. This is inserted in a slot punched in a shroud ring; the slots being punched by special machinery in such a way as to produce accurate spacing and at the same time form the slots so that they will give the proper angles to the blades independently of the slots in the base ring. After the blade tips are inserted in the slots in the shroud rings they are riveted over by specially arranged pneumatic machinery.

The shroud rings are made in channel shape with outwardly projecting flanges, which, after assembly in the turbine, are turned and bored to give the necessary working clearance. The flanges of the channels are made so thin that although amply sufficient for stiffness, the shroud ring does not have the disadvantage of a solid shroud, which acquires a dangerous temperature by friction in case of an accidental contact of the rotating and stationary parts. It is claimed for this construction that the blades are stiffened against the effect of vibration in a much more substantial manner than by any other means thus far employed, while the use of a protecting shroud ring enables the working clearance to be made smaller, than in the case of naked blade-tips, without danger in case of accidental contact, thus reducing the leakage loss to a minimum; the leakage past the blade-tips being the principal source of loss in the steam turbine. As to the safety from damage in case of accidental contact, it is stated that this has been proved by experiment with actual blading, by throwing the bearings out of centre, so as to produce contact, without detrimental results. An incidental advantage claimed for this construction is that if by chance a blade should prove defective

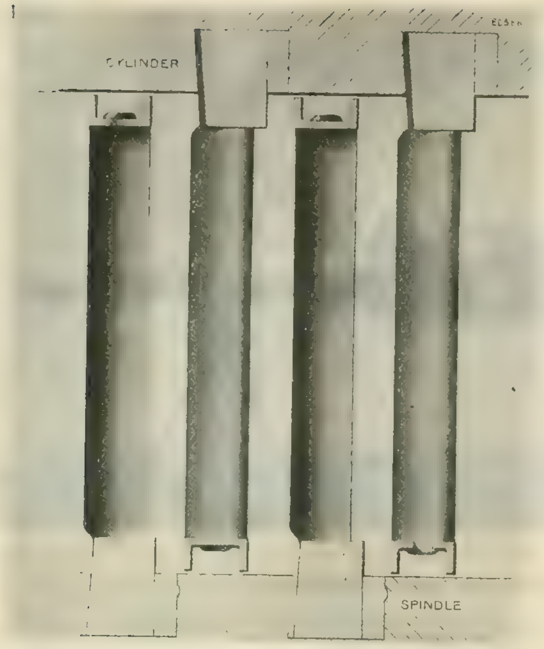


FIG. 2. GENERAL SCHEME OF BLADING.

it is so held in place by the shroud ring that it cannot possibly work loose and produce damage.

In the method of construction described, the entire blading is produced by machinery, thus eliminating the personal equation which enters into blading done by hand work, depending as it does upon the skill of the individual workmen. Besides ensuring that every blade is securely fastened, all blades are necessarily set at exactly the designed angle and pitch; the openings between blades, upon which in great part the economical performance depends, being absolutely uniform. The blading is made up in half-rings in the blading shop, and is carefully inspected before being inserted in the turbine.

OTHER DETAILS ILLUSTRATED.

Fig. 2, which was photographed from a drawing, shows the general scheme of the blading, and illustrates the method of fastening the blades as well as the channel-shaped shroud ring. Fig. 3 shows two half-rings of blades ready for assembly in a turbine; these halfrings being respectively the smallest and largest ones used in a turbine of the size installed at Utica. Fig. 4 is from a photograph of blading, showing construction. Further details of Fig. 5 shows a turbine spindle of the same size as that of the Utica turbine this photograph having been taken in the West Allis shops of the Allis. Chalmers Company.

ARRANGEMENT OF BALANCE PISTONS.

Another special feature will be noticed in this turbine, viz., the absence of the usual low-pressure " balance piston "; the photograph showing only two balance pistons instead of the three pistons formerly used in this type of turbine, where it is said to have been found difficult to produce a balance piston of the size required for balancing the low-pressure stage of the turbine and at the same time make it sufficiently rigid to run with the necessary small working clearance. In the construction of this turbine, there is, however, a third balance piston, but instead of being at the high pressure end of the turbine, as formerly arranged, it is at the low pressure end, and as it is smaller than the large end of the spindle it is hidden from sight in the photograph. By making this piston in such a way that its circular area is equal to the annular area of the pistons used in the older construction, the low-pressure balance piston is made much smaller. Instead of reducing the leakage past this piston by means of " dummy packing," as in the high-pressure and intermediate pistons, and as used in the low-pressure pistons of the older construction, a

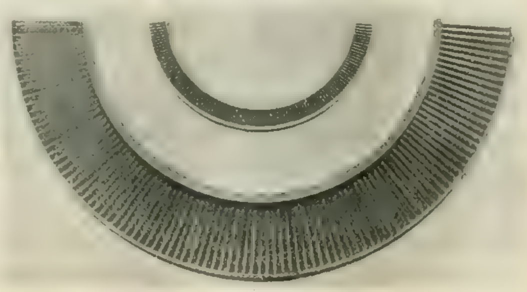


FIG. 3. BLADES READY FOR ASSEMBLY.

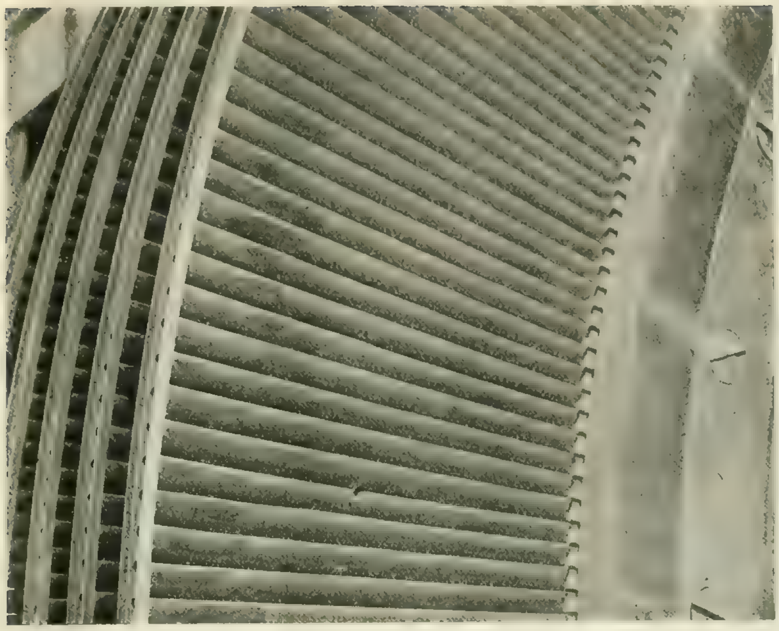


FIG. 4. BLADING CONSTRUCTION.

labyrinth packing of radial baffling type has been adopted, thus eliminating small axial clearance. A considerable advantage is claimed for this construction in permitting of the use of smaller working clearances in the high-pressure and intermediate balance pistons.

There are a number of other points of improvement claimed for this construction which will not permit of description within the space of the present article. These include details of spindle construction, governing mechanism, lubrication, and various minor features.

THE GENERATOR.

The alternating current generator of the Utica outfit also is deserving of more description than the present article will allow. Perhaps the most noticeable feature of this generator is the substantial design of the revolving field, providing great strength and at the same time giving the thorough ventilation which is essential. Particular attention has been paid to the insulation, as may be inferred from the fact that the armature was subjected to an alternating current insulation test of 10,000 volts for the period of fifteen minutes. This generator was built at the Bullock Works of the Company at Cincinnati, where the generators for all of their other turbine outfits are being built.

The Allis-Chalmers Company, in entering the steam turbine field, effected an alliance with the Turbine Advisory Syndicate of England, thereby securing the co-operation of the firms therein interested, including Messrs. Willans and Robinson, of Rugby; Yarrow, and Company, London; and the Neptune Shipbuilding Works, Walker-on-Tyne. The Utica turbine, in fact, was built for the Company by Messrs. Willans and Robinson, to whom a number of turbine contracts were sub-let by the Allis-Chalmers Company before the latter had perfected the installation of their special machinery for turbine manufacture. An agreement has more recently been effected with Hon. Charles A. Parsons, C.B., for interchange of data, thereby giving to the Allis-Chalmers Company the benefit of the vast experience of the original inventor of this type of turbine, to whose engineering ability and indomitable energy the evolution and present state of perfection of the successful steam turbine are principally due. They have also secured rights under Mr. Parsons' patents for marine turbines and turbo-compressors and blowers.

At present steam turbines are being built in the engine works at West Allis. The growth of the business, however, has led to a large extension of the works, amounting practically to a doubling of the present plant.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Leyton, (Essex).—Construction of nine miles of double tramway track, and for all materials connected therewith, for the Leyton Urban District Council. Mr. William Dawson, M.Inst.C.E., surveyor, Town Hall, Leyton ... .. Jan. 8

Bristol.—Supplying, fixing, setting, and mounting of two Cornish boilers, 5 ft. 6 in. diameter and 15 ft. 6 in. long, at their workhouse at Eastville, and removal of two boilers now in use, for the Guardians. Mr. J. J. Simpson, clerk, St. Peter's Hospital, Bristol ... ... Jan. 8

Southsea.—Extension of pier, for the Southsea Clarence Esplanade Pier Company. Mr. Alfred H. Bone, engineer, 148, High Street, Portsmouth . ... Jan. 10

West Hartlepool.—For the works required in connection with the reconstruction of No. 4 graving dock, West Hartlepool, for the North-Eastern Railway Co. Mr. T. M. Newell, engineer, Dock Office, Hull ... ... Jan. 10

Manchester.—For the reconstruction of Poland Street Bridge and Jersey Street Bridge over the Rochdale Canal, for the Improvement and Buildings Committee. City Surveyor's Office, Town Hall, Manchester ... ... Jan. 16

Cromer. — Supply, excavation for, and laying of about 3,050 yards of 4-in. cast-iron pipes, together with other works in connection therewith, for the water supply of West Runton, near Cromer, for the Cromer Urban District Council. Mr. J. C. Melliss, M.Inst.C.E., 264, Gresham House, Old Broad Street, E.C. Jan. 15

Lambeth, S.E. — Rebuilding a pair of horizontal engines at the Renfrew Road Workhouse, including new 15-in. cylinders, pistons, connecting-rods, etc., and turning up a 10 ft. flywheel. Mr. George E. Arnold, 26, Victoria Street, Westminster, S.W. .. .. Jan. 16

London.—Supply and delivery of about 2,300 tons of steel slot rails required in connection with the reconstruction for electrical traction on the conduit system, of certain of the Council's tramways North of the Thames, for the London County Council. Engineer's Department, County Hall, Spring Gardens, S.W. .. ... Jan. 16

Last Day

Nelson. — Construction of an inclined retort stack (36 mouthpieces) with all hydraulic mains, stage floors, coal conveyors, charging apparatus, etc., in the existing retort house at their Brierfield works, for the Gas Committee. Mr. A. J. Hope, engineer, Gas Offices, Nelson. Jan. 17

Swansea.—Extending seaward the existing West Pier, for the Swansea Harbour Trustees. The extension to be either for 800 ft., 1,000 ft., 1,200 ft. or 1,400 ft. as the Trustees may determine. Mr. A. O. Schenk, M.Inst.C.E., Engineer's Office, Swansea ... ... Jan. 18

Stratford-upon-Avon.—Manufacture delivery, and erection of three sets of gas or oil engines and pumps, for the Corporation. Messrs. Willcox and Raikes, Union Chambers, 63, Temple Row, Birmingham ... ... Jan

Wimbledon.—Supply and fixing of air-compressors, to be electrically driven, at the pumping station, Durnsford-road, Wimbledon, for the Wimbledon Corporation. Mr. C. H. Cooper, M.Inst.C.E., Town Hall, Wimbledon .., ... Jan. 22

London, E.—Reconstruction of a swing-bridge carrying Old Gravel Lane over the entrance to the East London Dock, in the metropolitan borough of Stepney, for the London County Council. Mr. Maurice Fitzmaurice, C.M.G., County Hall, Spring Gardens, S.W. ... ... Jan 23

Great Northern Railway.—Construction of Contract No. 1 from Enfield to Cuffley, being a length of five miles or thereabouts, for the Great Northern Railway Company. Engineer of the Company, King's Cross Station, London, N. ... ... Jan. 23

Huddersfield.—The following works, for the Corporation—viz: (Contract No 1) intercepting sewer, sedimentation tanks, detritus tanks, bacteria beds and other works contingent thereon; (Contract No. 2) gas-plants, gas-engines, generators, air-compressors and motors, pumps and motors, sludge pumps, switchboard, etc.; (Contract No. 3) sewage screen and elevator; (Contract No. 4) sewage discharge recorder; (Contract No. 5) sewage distributors and cables. Mr. K. F. Campbell, Engineer to the Corporation ... .. Jan. 27

COMING CONTRACTS.

Wolverhampton. — The Waterworks Committee of the Town Council have decided to make an extension of the waterworks undertaking. The scheme involves a cost of £90,000. This sum includes £6,545 for a triple-expansion engine, with bore-hole and ram pumps, £14,500 for a supplemental reservoir, £20,000 for a 24-in. pumping main, two miles long, £8,500 for two new trunk mains into the town, and £4,000 for new sidings and ropeway walks.

Sheerness. — The Admiralty has decided that the electric lighting and power installation at Sheerness Dockyard is to be taken in hand without delay. The work is to be the subject of private contract.

Huddersfield.—The Town Council have decided to invite tenders for carrying out sewage disposal work. The scheme involves the expenditure of some £135,000.

Ilford. — The proposed borrowing of £5,000 for purposes of electric lighting formed the subject of a Local Government Board inquiry held last week by Lieut-Colonel A. C. Smith, R.E.

Worthing.—A scheme has been proposed for extending the waterworks at an estimated cost of £16,000

Dolgelly.—The Council have decided to invite tenders from electrical engineers to prepare a preliminary report on the question of electricity supply.

Dundee.—The erection of a new generating station, at a cost of £75,000, is recommended by the city electrical engineer.

CONTRACTS CLOSED.

London.—The contract for the supply of oils to the London County Council for 1906 has been placed with the British Boiler Fluid and Engineers' Stores Company, Ltd.

Admiralty. — Messrs. Johnson and Phillips, Ltd., have received the contract for the conduits, feeder, and arc lighting cables, underground boxes and lamp pillars for the Portland coaling depot for the Admiralty.

L. B. and S. C. Railway.—The British Thomson-Houston Company is associated with the Allgemeine Elektricitats Gesellschaft in the electrification of the South London line of the London, Brighton and South Coast Railway, which contract has been given to the German firm. The Winter-Eichberg single phase system is to be used, the British rights for which are owned by the Thomson-Houston Company.

Shoreditch.—The Borough Council of Shoreditch has accepted the tender of the Stirling Boiler Company for three water-tube boilers, superheater, etc., at £6,605, and steam and water pipes, valves, etc., at £1,175 in connection with the extension of the plant at their Whiston Street generating station.

Buenos Ayres.—An order has been placed by the Buenos Ayres and Pacific Railway with the Brush Electrical Engineering Company for a number of steel wagons to the designs and under the patents of the Sheffield-Twinborrow Steel Car Company, Newcastle-on-Tyne.

Horwich.—Messrs. Joseph Berry (Limited), Swinton, have received a contract for two 10-ton cranes and one 20-ton electric crane for the railway works at Horwich. They are to lift their full load at the rate of 24 ft. per minute.

London Water Board.—Messrs. James Watt and Co., of Birmingham, have secured the contract for a horizontal tandem compound engine and deep well pumps for the Westerham Hill Waterworks of the Metropolitan Water Board.

Pernambuco.—Messrs. Manlove, Alliott and Co., of Nottingham, are supplying a refuse destructor to Pernambuco.

APPOINTMENTS VACANT.

Aberdeen.—The Town Council have decided to appoint a general manager, at £300 per annum, to take charge of the tramway undertaking, including rolling stock, but exclusive of electrical and mechanical equipment and permanent way ... ... Jan. 20

Salford.—An assistant lecturer in mechanical engineering is required at the Royal Technical Institute, Salford ... ... Jan. 10

Newcastle.—A lecturer in physics is required at Armstrong College, Newcastle-on-Tyne. Salary £200, rising by annual increments of £10 to £250... ... Jan. 13

Bradford.—The Corporation invite applications for the appointment of three engineering assistants in the sewage works, Engineer's Department, at a salary of £150 per annum each. Frederick Stevens, town clerk ... ... Jan. 16

Auckland, New Zealand.—Applications are invited for the appointment of City Engineer to the City of Auckland. High Commissioner for New Zealand, Westminster Chambers, 13, Victoria Street, London, S.W. ... ... Feb. 8

APPOINTMENTS FILLED.

Ipswich.—Mr. C. W. S. Oldham, assistant water engineer to the City of Hull, has been appointed waterworks engineer and manager under the Ipswich Corporation.

London.—Mr. F. H. Nash, A.R.S.M., of the city engineer's department, Norwich, has been appointed assistant instructor at the Royal School of Mines.

Grantham.—Mr. J. E. Edmundson, late manager of the Scarborough Tramways has been appointed manager of the electric lighting department of Grantham and Stamford.

Newcastle. — Mr. W. E. Miles has secured an appointment with the Newcastle-upon-Tyne Electricity Supply Company.

Leeds.—Mr. A. W. Ashton, M.Sc., has been appointed assistant lecturer and demonstrator in electrical engineering at Leeds University.

West Ham.—Mr. A. Hugh Seabrook has been appointed engineer and manager to the West Ham Corporation Electricity Supply.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—
Consols: Feb. 1st. General Settlements: Jan. 11th, 25th; Feb 8th. Bank Rate, September 28th, 1905, 4 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2¾—3
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4⅝—4¾
8,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 3/16—3 5/16
76,970	5	2/-	Do. 4% Cum. Pref.. ..	5	5⅜—5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	101—103*
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt. Debs. Red.	100	94—97*
530,000	1	1/7⅕	Babcock and Wilcox, Ltd., Ord. ..	1	3¾-4
100,000	1	7⅕d.	Do. ,, 6% Cum. Pref.	1	1 7/16—1 9/16
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5—5½
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 1/16—1 3/16
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101—103*
150,000	4½	3/-	Barrow Hæmatite Steel Co., Ld., O.	4½	5—5¼
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	5—5¼
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾—5¼
£500,000	100	4½%	Beardmore (Wm.) & Co, Ltd. 4½% 1st Mt. Debs., Red., Scrip 50% pd,	—	102½—104½
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	12¾—13¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	98—100
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	[illegible]
300,000	1	6⅗d.	Do. 5½% Cum Pref.	1	11/16—13/16
£300,000	Stk	4¼%	Do. 4¼% Red. Deb. Stock	100	91—94*
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	[illegible]
1,860,900	1	3⅗d.	Do. Nos. 1,639,101-3,500,000	12/-	[illegible]
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1 5/16—1 7/16
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅞—2
74,000	10	5/-	Do. 5% Cum. Pref.	10	11¾—12¼
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord. ..	5	10¼—10¾
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5¼—5¾
450,000	1	1/2⅖	Clayton & Shuttleworth, Ltd., Ord.	1	31/32—1 1/32
70,000	5	2/6	Do. 5% Cum. Pref	5	5⅛—5⅜
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	99—101*
100,000	10	30/-	Consett Iron Co., Ltd., Ord.. ..	7½	35—36
57 031	10	10/-	Crossley, Bros., Ld., Ord 40340/97370	10	15¼—15¾
40,339	10	5%	Do 5% Cum Pref.	10	11¼—11¾
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2¼—2¾
1,259,594	1	3⅗d.	Dorman, Long & Co., Ltd.	1	⅞—15/16
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	90—93*
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	3¾—4¼
250,000	1	9⅗d.	Dunlop (James) & Co., Ltd., Ord...	1	[illegible]
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	[illegible]
4,721	13	13/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	10½—11½
69,754	13	10/-	Do. do. do.	10	9—9½
20,250	10	8/-	Elliott's Metal, Ltd.	8	5—5½
5,000	10	5%	Do. Cum. Pref. 5%	10	8½—9*
186,748	Stk	4%	Do. Deb. 4%	100	94—97*
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	11½—12
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100—103
126,000	3	2/4½	Fraser & Chalmers, Ltd., Ord. ..	3	3¾—4¼
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5¾—6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	7½—7¾*
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	86—87*
16,800	10	10/-	Greenwood & Batley, Ltd., Ord. ..	10	6½—7
9,600	10	7%	Do. 7% Cum. Pref.	10	10¾—11¼
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2⅝—2¾
344,000	5	2/6	Do. 5% Cum. Pref.	5	6⅛—6⅜
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	104—106*
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2¾—3¼
250,000	1	1/-	Hadfield's Steel F'dry Co., Ld., Ord.	1	3⅝—3⅞
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½—11*
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	4¾—5¼
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	⅞—1
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	98—100
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	5½—6
85,000	1	7⅕d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	13/16—15/16
18,000	5	3/-	Do. 6% Cum. Pref.	5	5—5½
£100 000	Stk	6%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	100—103

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
750,000	1	7½%	Howard & Bullough, Ltd., Ord. ..	1	1 9/16—1 11/16*
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12¼—12¾*
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	96—99*
37,500	10	20	Kynoch, Ltd.	10	18¼—18¾
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅝—10⅞
300,000	1	4⅘d.	Lambert Bros., Ltd., Ord.	1	⅝—⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4—4½*
40,000	3	2/1⅕	Leeds Forge Co., 7% Cum. Pref. ..	3	4-4½
200,000	1	7⅕d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16—1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108—110*
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11¼—11¾
210,000	1	8⅘d.	Measures Bros., Ltd., Ord.	1	[illegible]
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	15/16-1 1/16
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	98—101
21,943	5	2/6	Muntz Metal, Ltd.	5	4¾—5¼
14,248	5	5%	Do. Pref. 5%	5	4¾—5¼
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	78—81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅜—12⅝
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	87—91*
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	5—5¼
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	6—6½
70,000	10	10/-	Pease & Partners, Ltd., Ord. ..	10	13—13½
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock ..	100	99—102
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm.P.	5	4⅞—5⅛
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	10/3—10/9
13,000	5	—	Do. 5½% Cum Pref.	5	4⅝—4⅞
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	[illegible]
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	2 1/16—2 3/16
73,062	5	2/-	Do. New	5	1⅞—2
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	100—102*
350,000	1	1/2⅖	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000 ..	1	15/16—1
£350,000	1	7⅕	Do. 6% Cum. Pref.	1	15/16—1 1/16
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	99—101*
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	10½—11
275.000	1	6d.	Scott (Walter) Ltd., Ord.	1	[illegible]
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	1—1 1/16*
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	92—95*
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	92—95*
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	96—100*
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	[illegible]
300,000	1	1/2⅖	Do. 6% Cum. Pref...	1	15/16—1 1/16
£300.000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	91—94*
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2¾—3
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	5¼—5¾
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	78—81*
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	19—19½
55,000	10	6/-	Do. 6% Cum. Pref.	10	14½—15
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	⅞—15/16
538,845	1	6d.	Do. 5% Cum. Pref.	1	15/16—1 1/16
£240,000	Stk	4¼%	Do. 4¼% 1st Mort. Deb. Stk. Red	100	96—99*
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	9/16—11/16
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	80—84
£148,500	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. Or.	1	13/16—15/16
£160,000	1	7⅕d.	Do. do. 6% Cum. Pref.	1	15/16—1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9—9½*
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	44½—44¾
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	109¾—110¼
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	99—101
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord..	1	2¾—2⅞
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1 3/16—1 5/16
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	106	121—124
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	103—105
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	104—106
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	1 3/32—1 5/32
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord. ..	1	1 5/32—1 7/32
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	92—96
66,666	5	3/.	Willans & Robinson, Ord.	5	1¾—2¼
66,666	5	3/-	Do. 6% Cum. Pref.	5	3½—4
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	82—87
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	10	77—79

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares.	Last Divi-dend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	13/16–1 1/16
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	½ – ⅝
120,000	1	1/2⅖	Bell's Asbestos Co., Ltd.	1	1½–1⅝
£40,000	5	9d.	British Aluminium Co. 7% Cum Pref.	5	5¼– 5¾
£300,000	Stk	5%	Do 5% 1st Mort. Deb. Stk. Rd.	100	98 –102
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	6½– 7
100,000	5	3/-	Do. 6% Cum. Pref.	5	5¾ - 6¼
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	103 –106*
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	98–100
400,000	5	8/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref. ..	5	1¾– 2¼
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	78 – 83*
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	¼– ½
150,000	2	2/4⅘	Do. 6% Pref.	2	1¼– 1¾
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	96 –100
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	82 – 84*
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11 – 12
40,000	5	2/6	Do. 5% Cum. Pref.	5	5½– 5¾*
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	107 -109*
85,000	3	1/6	Crompton & Co., Ltd...	3	2 1/16 – 2 5/16
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	95–98%*
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	8½ – 9
61,000	5	8/-	Do. 6% Cum. Pref.	5	5¾– 6¼
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	104 –106*
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛– 1⅜*
£233,334	Stk	4%	Do. 1st Mort. 4% free. Deb. Stk.	100	106 –109*
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1⅜– 1⅝
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2¼ – 2¾
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	86 – 88*
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	92– 97
112,100	2	1/7⅕	Electric Construction Co., Ltd. ..	2	½ – ¾
31,390	2	2/9⅗	Do. 7% Cumulative Pref. ..	2	1⅛– 2⅜
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	92 – 95
10,248	10	7/6	Evered and Co., Ltd...	10	9 – 11
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9 – 9½*
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	96–100
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12½–13½
35,000	5	2/3	Do. 4½% Cum. Pref... ..	5	5⅛– 5⅝
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	—
50,000	10	15/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	18 – 19*
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	99 –102
7,500	10	—	Parker, Thos., Ltd.	10	6½ – 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	17/3 –17/9
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	32½– 34½
150,000	100	4%	Do. 4% Deb. Bonds	100	100–102*

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares.	Last Divi dend.	Name	Paid up.	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8¾ – 8⅞
260,007	5	2/9	Do. 5% Cum Pf.	5	5¾– 6*
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 –143*
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	13¾– 14¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9½– 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	98 –101
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97 –102
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	15/16– 1
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	15/16–1 1/16*
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1 – 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	4 – 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	93 – 96*
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	120–123
		5%	Pref. Ord. Stock	100	107–111
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	8 –8½
156,437	10	6/-	Do. 6% Cum. Pref... ..	10	10 –11
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	117 -119
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	97 –99
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3⅜–3⅞
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5 11/16–5 13/16
27,000	5	3/-	Do. "B" do.	5	5 – 5½
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	96–98*
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	100–104*

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Divi dend.	Name	Paid up.	Closing Prices
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	9¼ – 9¾
£350,000	Stk	4%	Do. 4½% 1st Deb. Stk., Red.	100	105 107*
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	⅞ –1⅛
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞ –5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101–104*
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	102–104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13¼–14¼
59,987	10	6/-	Do. 6% Pref...	10	14½–15½
£125,000	Stk	4½	Hastings & Dist. Elec. Trams. Co., Ltd., 4% Deb Stock, Red. ..	100	101 103
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2¼– 2¾
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	82 – 87*
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9½–10*
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 –101*
60,007	1	1/-	London Motor Omnibus Co., Ltd., Ord. No. 1—60,007	1	1¾–2*
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	101 –103*
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	[illegible]
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 –1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	102 –104*
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½– 1½
110,923	8	2/9½	North Metropolitan Tramways Co..	8	4 – 4¼
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	92 – 97*
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	102 –105*
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¾– 9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9¾ - 10¼
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	103 –106
£160,000	Stk	5%	Sunderland Dist. Elec. Trams. Ltd., 5% 1st Mort. Deb. Red... ..	100	92–97*
£275,000	Stk	4½%	Yorkshire (W. Riding) Elec. Trams. Co., Ltd., 4½% 1st Deb. Stk., Red.	100	94–96

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Divi-dend.	Name	Paid up.	Closing Prices
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12¼ – 12¾
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10⅛–10⅝
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11¾ – 12¼
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	105 –107*
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼– 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	102 –104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	8½ – 9¼
12,493	5	3/3	Do. 7% Cum. Pref. Shares..	5	9 – 9½
60,000	5	3/3	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	8¼ – 9¼
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	102 –105
70,000	5	2/6	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	5¾– 6¼
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5¼ – 5¾
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	101 –103*
41,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	5 – 6
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 –110*
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11 – 12
40,000	10	6/-	Do. 6% Cum. Pref.	10	13¼ –14¼
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	122½–126*
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	101 –103*
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	8½– 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12¼–12¾
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	110 –113*
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5¼ - 5¾
70,000	5	3/-	Do. 6% Cum. Pref.	5	5¾ – 6
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	107 –109
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	85 — 90*
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O.	5	5¼ — 5¾
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 –104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9 — 10
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	8¼ – 8¾
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100–103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	⅞ – 1
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	10¼–11¼

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101—103
111,000	3	1/9⅜	London Elec. Supply Corp., Ld., Ord.	3	1¾ - 2¼
60,000	5	3/-	Do. 6% Pref.	5	5 — 5½
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	97 —100
100,000	10	5/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	9½—10½
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅛— 5⅜
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	107 —111*
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	96— 98*
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99—100%*
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	13¾— 14¾
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	98 —100
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6⅜ — 6⅞
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	100 —102
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —103
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	12¾—13¾
20,000	5	3/6	Do. 7% Pref...	5	7¾— 8¾
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	97 — 99*
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2 — 2½
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	76 — 80
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3 — 3½
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	13/16 - 15/16
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	1 5/16—1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4½— 4¾
30,000	5	2/6	Do. 5% Cum Pref.	5*	5 — 5¼
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104 —106
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	11½—12½
28,151	5	2/6	Do. 5% Cum. Pref.	5	5⅝— 6⅛*

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£84,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	98 —101*
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	3¾— 4¼
£763,580	Stk	14/-	Anglo-American Tel. Co.. Ltd., Ord.	100	62½— 64½
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	109½—110½
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	17½— 17¾
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7¾— 8
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	——
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96 — 98*
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8½— 9
6,000	10	10/-	Do. 10% Preference	10	17 —18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Preference	5	8¾— 9¼
£30,000	50	4½%	Do. 4½% Debs...	50	98-101%*
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	14 —15
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	91 —101*
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100½—102½
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	100-102½%
800,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14¼—14¾
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 - 108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	145 --148
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	90 —92
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	106 —108
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	36 — 38
£58.700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	91 —101*
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	57 —59
£251,127	1		Marconi's Wireless Tel. Co., Ltd. ..	1	1¼ —1⅜
72,080	1	9⅗d.	Monte Video Telephone Co., Ltd., O.	1	⅞— 1
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	110½—111½
£1,966 667	Stk	5%	Do. Deferred	100	108 —110
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅜ — 5⅞
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	98 —100*
£689,593	Stk	4%	Do. 4% do. do. ..	100	102½—104½
179,313	1	7⅕d.	Oriental Telephone & Elec. Co., Ltd.	1	1¼ — 1⅜
50,000	1	7⅕d.	Do. 6% Cum. Pref.	1	1¼ —1⅜
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	98 —101*
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7¼ — 7¾
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7¼ — 7⅝*
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛— 5⅝*
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	109 —111*
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	9½—10
£30,008	2½	—	West Coast of America, Ltd. ..	2½	9/16 - 11/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	99—101*

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	½— ¾
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8¼— 8¾
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6½— 7½
£80,000	100	5%	Do. 5% Deb.	100	99 —102*
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13¾—14¼
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	100 —102*
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	101½—103½*

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	9¼— 9¾
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	100—102
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	97 — 99*
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6¼— 6¾
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	———
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	97 — 99*
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	13¼— 13¾
40,000	20	8/-	Do. Nos. 60,001-100,000	10	5¾— 6¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	102—104
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1½ — 1⅝
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5½
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	8¾— 9¼
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	96 — 98*
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	1 — 2
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2¾— 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	85 — 88*
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	5½— 6
20,349	10	5/-	Orient Stm. Nav. Co., Ltd., Pref. Nos. 1-20,349 ..	10	7 — 7½*
£103,100	Stk	4%	Do. 4% Deb. Stk., Red. ..	100	87— 90*
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	126—129
£1,160,000	Stk	19%	Do. do. Deferred ..	100	238—241
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	46— 47
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	3¾— 4¼
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8½— 9
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10½— 11*
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	99 —101*

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
60,000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 —1¼
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	123 —128
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	26 — 28
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 5
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	¼ — ⅜
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	⅜— ½
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16 —1 3/16
135,000	1	7⅕d.	Do. 6% Cum. Pref. ...	1	1⅛—1½

RAILWAY CARRIAGE & WAGON COMPANIES.

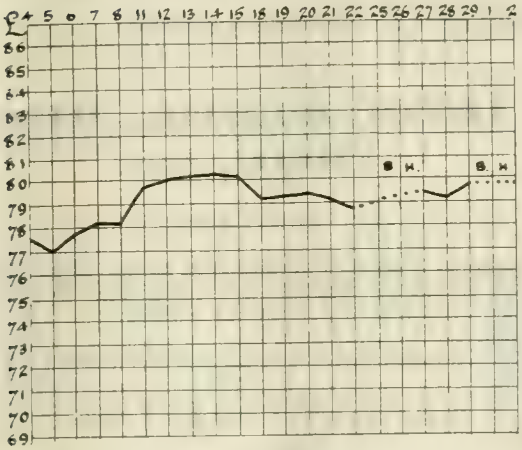
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	26 — 26½
8,739	10	3/-	Do. Second Issue 1-8,739....	4	9¾—10
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 —14⅛
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	10½— 10¾
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4½— 4¾
14,567	10	1/3	Lancashire Wagon, Ord.	2	2⅛— 2¼
4,150	10	5%	Do. do.	10	10⅜—10⅝
781,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	43/- —44/-
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	24/6—25/6
235,000	1	7⅕d.	Do. Cum. B Pref. 6% 1-235,000	1	28/6—29/6
20,000	20	20/-	Midland Rail.-Car & Wagon, Ld., 1-20,000	10	20¾— 21¼

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM DECEMBER 4TH, 1905, TO JANUARY 2ND, 1906.

COPPER.



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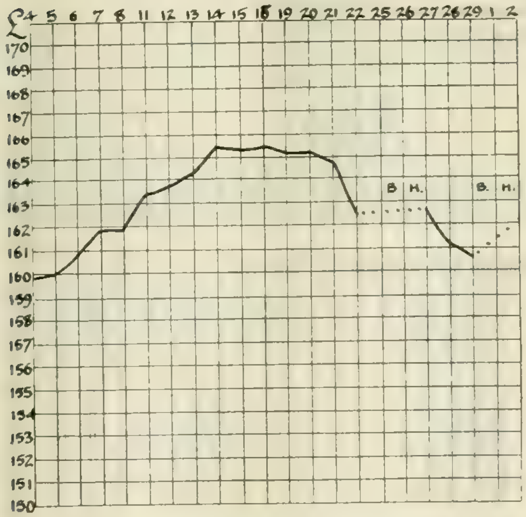
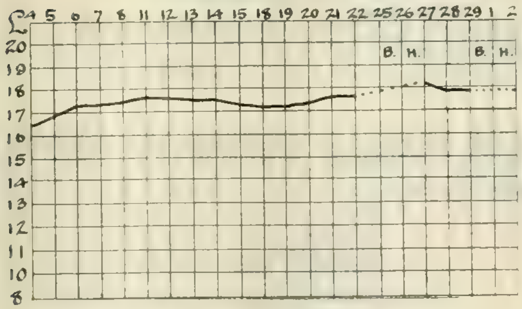
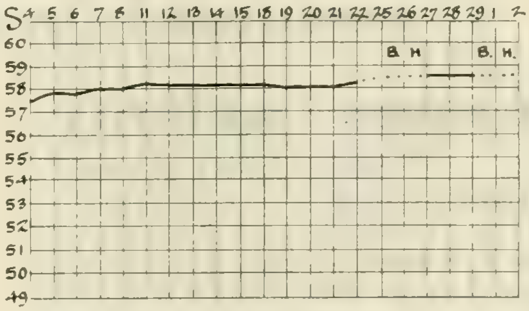


ENGLISH LEAD.



PIG IRON: SCOTCH.



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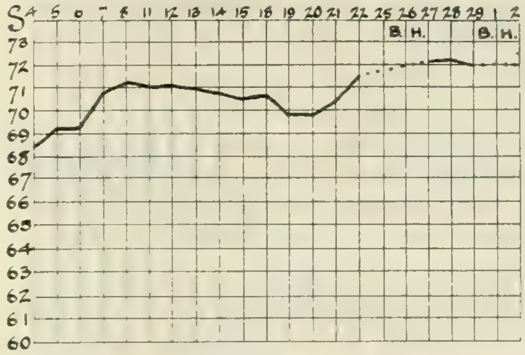
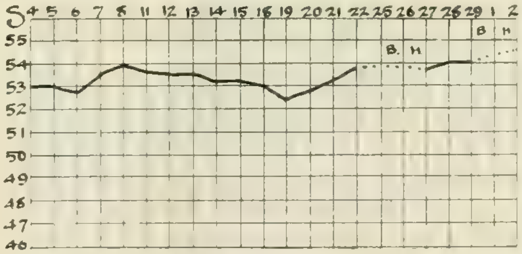
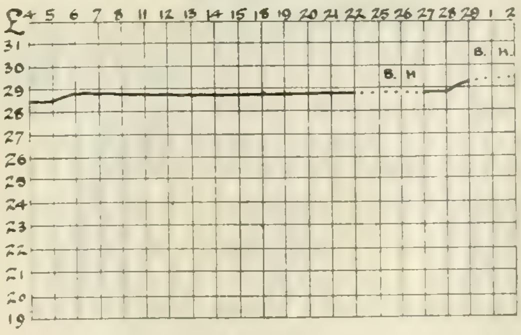


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, January 3rd, 1906.

WITH supplies in the copper market still restricted, the tone since the holidays has been firm. Messrs. H. R. Merton and Company give the visible supply as 12,983 tons, against 13,690 tons at the end of November. The total supplies for December amount to 25,646 tons, and the deliveries to 26,353 tons, against 21,333 tons and 23,365 tons respectively for November. The scarcity of refined copper remains unrelieved, and it is almost impossible to buy any quantities of importance from American producers for delivery before April. China is the only country to which we can look for supplies, but the copper now purchased will only be available in Europe during March and April. The closing quotations are £80 2s. 6d. cash, and £79 16s. 9d. three months.

There have been large dealings in tin, and the price ran up to £163, but the East became a seller in anticipation of unfavourable statistics, and there have been forward sales and heavy realisations on behalf of leading operators. The shipments from the East during the present month will probably be heavy. The closing price to-night is £160 17s. 6d. cash.

In a sensitive market which has been the medium of a good deal of speculation, lead has touched a new high record, £17 17s. 6d. being at one time paid for forward delivery There was somewhat free offering however at this quotation, and the market is lower at £17 10s. In the Spelter market, a revival is to be noted, and with ordinaries quoted at £29 5s. od. a new high record has been set up.

In the Iron and Steel section there has been a real activity in warrant iron, Cleveland having advanced to 54s. 8d. cash, while hematite has risen to 72s. 6d. The latest reports from trading centres indicate that the prospects for the new year are very encouraging and iron and steel foundries are busy, particularly in engineering and shipbuilding classes of castings. Pig-iron makers are expecting another rush of orders, and there is talk of prices going higher, but a good deal will depend on the statistical position to be disclosed by the makers' annual returns, showing production, consumption, and stock of pig-iron in Scotland, which are not available at the time of writing.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel :	£	s.	d.
Siemens' Steel Plates, Marine Boiler Quality	8	2	6
,, ,, ,, Land ,, ,,	8	2	6
,, Steel Bars Boiler Quality	8	5	0
Siemens' Steel Plates, Ship Quality Plates	7	2	6
,, ,, Bars ,, ,,	7	15	0
,, ,, Angles	6	15	0

Manufactured Iron :

Bars—Dalzell	7	2	6
,, Best	7	12	6
,, ,, Horseshoe	7	12	6
,, Angle	7	2	6
,, Best Angle	7	12	6
,, Best Best	8	2	6
,, Extra Best	8	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

Malleable Common Bars:	£	s.	.	
Dalzell, per ton	7	2	6	5 per cent
Govan	6	10	0	,,
North British	6	10	0	,,
Drumpellier	6	7	6	,,
Waverley	6	10	0	,,
Crown	6	5	0	,,
Dundyvan	6	5	0	,,
Muirkirk	6	5	0	,,
Rochsolloch	6	5	0	,,
Phœnix	7	5	0	,,
Coatbridge	7	2	6	,,
Coats	6	5	0	,,
Angle Iron		—		,,
Steel Plates, ship		—		,,
,, Boiler Plates		—		,,
Rails		—		,,
Railway Chairs		—		,,

G.M.B. at Glasgow, No. 1, 64s. ; No. 3, 61s.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote :—

	£	s.	d.
Bars—Phœnix	7	5	0
,, Best	7	15	0
,, Best Best	8	5	0
,, Extra Best	8	15	0
,, Best Horse Shoe	7	15	0
,, Extra B.H.S.	8	15	0
,, Extra Best Cable	9	5	0
,, Rivet	7	5	0
,, Best Scrap Rivet	8	5	0

	£	s.	d.
Angles—Phœnix	7	5	0
,, Best	7	15	0
,, Extra Best	8	5	0
Gas Tube Hoops—Phœnix Best	7	15	0
Plates—Phœnix		—	
,, Best Boiler	8	10	0
,, Best Best Boiler	9	0	0
,, Extra Best Boiler	10	0	0
Boiler Tube Strips—Phœnix	9	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra).

Pig Iron:	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	3	16	0	3	6	0
Gartsherrie ,,	3	8	6	3	3	6
Summerlee ,,	3	11	0	3	6	0
Carnbroe ,,	3	5	6	3	2	6
Langloan ,,	3	10	0	3	5	0
Calder ,,	3	7	6	3	2	6
Clyde ,,	3	8	0	3	3	0
Glengarnock, f.o.b. Ardrossan	3	8	0	3	3	0
Eglinton ,, ,,	3	3	0	3	0	0
Dalmellington, ,, Ayr		—		3	0	0
Shotts ,, Leith	3	7	6	3	2	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♔ Bars	7	5	0
W.W. Best Bars	7	12	6
W.W. Best Best	8	0	0
W.W. Best Best Best	8	7	6
W.W. Best Shoe	7	15	0
Thornaby ♔	8	15	0
Thornaby Best	9	5	0
Thornaby Best Best	10	5	0
Whitwell Special Admiralty Cable	10	15	0
Special Chain Iron	9	15	0
Tube and Nail Strip iron net cash	7	5	0
W.W. ♔ Angle Iron	7	7	6
W.W. Best Angle Iron	7	15	0
Tee Iron, to 8-inches United	8	5	0

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd., Dallam and Bewsey Forges, Warrington, quote as follows:—

		Iron.			Steel.		
		£	s	d.	£	s.	d.
♔ (BN)	Bars	7	10	0	7	15	0
	Angles	8	0	0	8	5	0
	Tees	8	10	0	8	15	0
♔ W.I.W	Hoops	7	10	0	8	0	0
	Sheets	8	15	0	9	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

Lots under 10 cwts. of a size 10s. per ton extra.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets	£	s.	d.	£	s.	d.
"Vale"	11	0	0	12	0	0
"Shield"	11	10	0	12	10	0
"Severn"	12	10	0	13	10	0
"Baldwin Wilden B."	13	10	0	14	10	0
Charcoal	17	10	0	18	10	0
Best Charcoal	19	10	0	20	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d	£	s.	d.
No. 3 Lead	14	10	0	15	10	0
S.V. Lead	16	0	0	17	0	0
No. 3 Terne	16	0	0	17	0	0
S.V. Terne	17	10	0	18	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	13	7	6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	16	0	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	14	7	6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	7	5	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ to 4in. rounds and squares)	7	15	0	,,
Angles	7	10	0	,,
,, Best	8	0	0	,,
T's	7	15	0	,,
,, Best	8	5	0	,,
Best Shoe Iron	7	15	0	,,
,, Rivet Iron	8	15	0	,,
,, Best Rivet (Special)	10	0	0	,,
,, Cable	10	0	0	,,
,, Screwing	9	0	0	,,

	£	s.	d.	
Best Turning	7	15	0	per ton.
,, Plating	9	0	0	,,
Best Best	10	0	0	,,
Treble Best	11	0	0	,,
Plates	8	5	0	,,
Best Plates	8	15	0	,,
,, Boiler Plates	9	5	0	,,
,, Best Boiler Plates	10	5	0	,,
Treble Best Boiler Plates	12	15	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

42½ per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

37½ per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

37½ per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis :—
2 tons 10/6 per cwt.
4 cwt. lots and upwards 10/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch to 6-inch basis—
2 tons 9/3 per cwt.
4 cwt. lots 9/6 per cwt. } d/d any Railway Station.
Slit rods (iron) £8 per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote :—

Coke Tin-plates.	Per Box. f.o.b. Wales. £	s.	d.
C 18¾ by 14 124s. 110 lb. "BV"	0	13	6
C 20 by 10 225s. 155 ,, "Jumbo"	0	18	9
C 20 by 14 112s. 108 ,, "Lydbrook"	0	13	3
C 28 by 20 112s. 216 ,, "Lydbrook"	1	6	9
Charcoal Tinplates :			
C 20 by 14 112s. 108 lb. "Allaway"	0	14	0

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes :—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:		£	s.	d.	
Blooms	at	4	4	0	per ton.
Billets	at	4	6	0	,,
Sheet Bars	at	4	8	0	,,
Finished Steel:					
Bars	at	5	15	0	per ton.
Angles	at	5	16	0	,,
Tees	at	5	19	0	,,
Joists	at	5	0	0	,,
Fencing Standards	at	5	15	0	,,
Shoeing Bars	at	5	19	0	,,
Tyre Bar	at	5	19	0	,,
Half-Round Bars	at	6	3	0	,,
Heavy Rails	at	5	10	0	,,
Light Rails	at	5	10	0	,,

Structural Steelwork :

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	164	0	0	to	164	10	0	per ton
English Bars, f.o.b. Dis. 1¼% & 1%	165	0	0	to	165	10	0	,,
Straits G.M.B., cash Warehouse, Net	162	5	0	to	162	10	0	,,
Straits G.M.B., 3 months, Warehouse, Net	162	5	0	to	162	10	0	,,
Australian, Mt. Bischoff, Warehouse, Net	162	15	0	to	163	0	0	,,

COPPER.

Copper:	£	s.	d.		£	s	d.	
Standard G.M.B., cash Warehouse, Net	79	12	6	to	79	15	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	79	7	6	to	79	10	0	,,
English, Tough, Cake & Ingot, Warehouses, Net	87	0	0	to	88	0	0	,,
English, Best Select, Warehouse Net	87	10	0	to	88	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	95	0	0	to	95	10	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	90	0	0	to	91	0	0	,,
Electro, Warehouse, Net	88	10	0	to	89	0	0	,,
Ore, ex. ship	0	14	9	to	0	15	9	per unit.
Regulus, Matte and Precipitate, ex ship,	0	15	9	to	0	16	3	,,

YELLOW METAL.

Yellow Metal:

	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	7¾	per lb
Sheathing ,, ,,	0	0	8	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	29	2	6	to	29	5	0	per ton.
Blende of 50 % Net	8	0	0	to	8	7	6	,,
Calamine, Net	8	9	0	to	8	10	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	17	15	0	to	17	17	6	per ton,
Spanish, ex ship, Dis. 2½%	17	10	0	to	17	12	6	,,
Lead Ore of 70 %, Net	8	10	0	to	8	15	0	,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	64	0	0	to	65	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	16	0	0	to	17	0	0	,,
Crude, ex ship, Dis. 2½ %	32	0	0	to	35	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	5	0	per flask
Italian ,, ,, ,,	7	2	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	6	6
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston, quote as follows, per ton at pit:

Kilburn Coal:

	s.	d.
Best London Brights	9	3
Large Nuts (1½ to 3¼)	9	0
Small Nuts (¾ to 1½)	6	0
Peas (⅜ to ¾)	5	0
Rough Slack	4	0
Slack	3	6
Smudge	2	0

Rutland Coal:

	s.	d.
Brights (4 to 8)	7	6
Large Nuts (2 to 4)	7	0
Slack	3	6
Hand-picked Hards	7	6
Hard Cobbles	6	3

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit :—

Digby Coal:

STEAM.

	s.	d
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL (or Ashless House Coal).

	s.	d.
London Brights, 4 to 8 in. cube	11	0
Bright Cobbles (Hand Picked)	10	6
Large Nuts, 2 to 4 in. cube	10	0
Small Nuts, 1 to 2 in. cube	6	3
Pea Nuts, ¾ to 1 in. cube	5	0

STEAM.—TOP HARD.

	s.	d.
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb
Picric, Crystals	0	0	11	,,
Tartaric … at Manchester	0	0	10½	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	8	10	0	per ton
Grey ,,	11	15	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	24	15	0	per ton
Sal-ammoniac, Lump, 1sts, deld. U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	12	18	0	,,
Arsenic: Best White Powdered net	15	0	0	,,
Bleaching Powder, 35% ,,	4	7	6	,,
Borax: British Refined Crystal ,,	13	0	0	,,

Coal Tar Products:

	£	s.	d.	
Benzole, 50/90 % ,,	0	0	8½	per gal
,, 90% ,,	0	0	9	,,
Carbolic Acid Crystals, 34/35° C. ,,	0	0	6	per lb
,, ,, ,, 39/40° C. ,,	0	0	6¼	,,
,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	10	,,
Creosote, ordinary good liquid ,,	0	0	1⅝	,,
Naphtha, Crude, 20 % at 120° C. ,,	0	0	4	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	1	0	,,
,, ,, 95 % at 160° C. ,, ,,	0	1	0½	,,
,, ,, 90 % at 190° C. ,, ,,	0	1	1½	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	1	1½	,,
,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	2½	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	12	6	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	18	6	,,
Cake ,,	1	1	6	,,
Copper: Sulphate	25	0	0	,,
Cyanides: 98% minimum f.o.b. net	0	0	8½	per lb.
Lead: Acetate (Sugar) White, English	28	0	0	per ton.
,, ,, ,, Foreign c.i.f U.K	25	5	0	,,
,, ,, Grey	23	10	0	,,
,, ,, Brown at Manchester	19	10	0	,,
Nitrate	26	10	0	,,
Litharge, Flake	18	10	0	,,
,, Powder	19	0	0	,,
Red Lead, Genuine, c.i.f London less 5%	19	0	0	,,
White ,, ,, Dry ,, ,,	20	0	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	4	per gal.
Solvent	0	2	7	,,
Potash: Bichromate... delivered England.	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull	17	15	0	per ton.
Caustic, 75/80 %	19	5	0	,,
Chlorate net	0	0	3¼	per lb.
Montreal ... in Store, Liverpool	31	10	0	per ton.
Prussiate Yellow net	0	0	4⅝	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
	,, ,, ,, Refined...... ,,	6	5	0	,,
	,, Carbonated, 48 %........... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
	Caustic, White, 77 %.............. ,,	10	12	6	,,
	,, ,, 70 %.............. ,,	9	12	6	,,
	,, ,, 60 %.............. ,,	8	12	6	,,
	,, Cream, 60 %..... .... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate .... c.i.f. Hull net	16	15	0	,,
	Bicarbonate, in 1 cwt. kegs...........	6	15	0	,,
	Bichromate......delivered England...	0	0	$2\frac{1}{4}$	per lb.
	Chlorate .... net	0	0	$3\frac{1}{4}$	per lb.
	Nitrate.,.ex quay Liverpool, ... ,,	11	0	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate ....net	0	0	$3\frac{7}{16}$	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)..............	1	10	0	,,
	,, (Saltcake, 95%)...............	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers..............................	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot.........	9	10	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote :—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports.........................	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool $10\frac{1}{4}$d.	per metallic unit.			
Ochre:	French JC .... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).........c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote :—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	15	6	to	0	16	6	per unit.
Regulus, 45 to 55%	0	16	6	to	0	17	6	,,
Precipitate, 65 to 80% ...	0	16	$7\frac{1}{2}$	to	0	17	$1\frac{1}{2}$	,,
Tin Ores, 70 %...............	106	0	0	to	108	0	0	per ton.
Lead Ore, 70%					9	4	6	,,
Blende, 50%					8	9	6	,,
Calamine.......................					8	12	0	,,
Antimony, Star Regulus	58	0	0	to	60	0	0	,,
,, Ore 50%......	15	10	0	to	17	0	0	,,

Messrs. Barrington and Holt, Cartagena, quote :—

Iron Ore.

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman	7	8	per ton.
Do.	,,	Cartagena	8	0	,,
Special low phos,	,,	Porman			
Do. do.	,,	Cartagena............	8	2	,,
Extra quality do.	,,	,, ...	8	6	,,
Special Iron Ore	,,	,, ...	nominal		,,
Specular 58% do.	,,	....	11	0	,,
S.P. Campanil Coast	,,	....	9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote :—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine...............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks.....................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	10	0		7	15	0
Nova Scotia Spruce..	,,	7	7	6		7	12	6
Spruce Boards................	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak..............	per load	12	0	0		19	0	0
Greenheart,....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish........................	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars............ ..	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

NEW PATENTS APPLIED FOR.

(December 18th—23rd.)

ENGINEERING—CIVIL, MECHANICAL, ETC.

26,892. K. A. Zugel, London.—Improved automatic smoke, soot, and steam preventing device for railway locomotives and the like.

26,918. H. H. Lake, London.—Improvements relating to superheaters.

26,931. E. Dyson, Manchester.—Improvements in fasteners for driving belts.

26,739. H. Cruse, Manchester.—Improvements in the construction of connection boxes or pressure reducing and like boxes for steam and other piping systems.

26,745. W. L. Brown, Reading.—Improvements in engine connecting rods.

26,763. Tangyes, Ltd., and J. H. Pitt, Birmingham.—Improvements in or connected with producer gas plants.

26,773. C. A. Holt, London.—Improvements in or relating to the means and apparatus for treating condensing water in its passage from the engine to the lodge or reservoir which is also applicable for treating cold water for other purposes.

26,779. C. J. Johnson and J. Carlaw, London.—Improvements in furnaces for steam generators.

26,785. E. W. Fraser, London.—Improvements in furnaces for steam boilers.

26,799. F. A. Wilmott, C. Cobon, and J. Driscoll, London.—Improvements in or relating to apparatus for scaling or cleaning boiler tubes and the like.

26,815. E. Einfeldt, London.—Improvements in turbine engines.

26,829. J. Fielding, Gloucester.—Improvements in suction gas generators.

26,841. R. Goudie, and A. Graham, London.—Improvements in turning, planing and screw-cutting tools and tool holders.

26,884. W. Delf and F. C. Joslin, London.—An improved drilling or boring tool.

26,626. C. Hagans, London.—Improvements in or relating to superheaters for steam generators.

26,643. W. B. Johnson, Liverpool.—Improvements in turbines.

26,647. J. Elcoate, Saltburn-by-Sea.—Floor and boiler covering.

26,656. A. T. Price, Birmingham.—An improved steam or other fluid pressure rotary engine applicable also for use as a pump, blower, exhauster or air compressor.

26,658. J. Kirby and M. R. Parker, Leeds.—Improvements in or relating to the valve mechanism employed for controlling direct-acting fluid pressure pumping and other engines.

26,668. F. Girod, Berlin.—Pressure pulsometer or force pump.

26,692. C. A. J. Albert, London.—Improvements in or relating to apparatus for catching and purifying waste oil from steam engines and the like.

26,719. F. Bailey and F. H. Jackson, London.—Improved means applicable for use in communicating rotary motion and in controlling the transmission thereof.

26,731. R. F. C. Keats and T. Wood, Portsmouth.—A rotary reversible compound gas or oil engine.

26,544. E. H. MacIlwaine, Belfast.—Improvements in and relating to the clearing of dust or other impurity out of air or other gases.

26,546. R. Richardson, Glasgow.—Improvements in direct-acting engines.

26,572. J. S. Pearson, Glasgow.—Improvements in the method of and means of mixing combustible gases with steam and air, or the like and consuming them in furnaces, fireplaces and the like.

26,594. W. Dagnall, London.—Improvements in and relating to turbines or rotary engines.

26,617. P. B. Jagger. London.—Improvements in and relating to the manufacture of concrete beams, pipes, slabs, and other concrete articles.

26,448. E. A. Fordyce, London.—Improvements in and relating to pneumatic dispatch tube apparatus.

26,450. M. J. Adams, Stockfield-on-Tyne.—Improvements in water regulating-apparatus.

26,456. A. Meyer, London.—Improvements in or relating to scales for gauge glasses.

26,492. E. W. Baird and J. P. Durkin, London.—Improvements in lubricators.

26,493. H. T. Atkin, Liverpool.—Improvements in protecting from corrosion from sea water iron or steel structures.

26,516. E. Carstens, London.—Improvements in cutter heads for planing machines.

26,365. A. J. Boult, London.—Improvements in or relating to piling for subways, foundations, shafts and other substances. (James J. Harold, United States.)

26,372. J. Jeffreys, London.—Improvements in connection with steam traps and controlling valves.

26,379. W. H. Lucas, London.—Improvements in turning crank-pins and machinery therefor.

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26,429. J. Dudley, Ontario.—Improvements in turbine engines.

26,346. E. J. Fuller, London.—Improvements in and relating to metallic packings.

26,359. A. J. Boult, London.—Improvements in roller bearings. (Samuel S. Eveland, United States.)

26,364. O. Lavanchy, London.—Improvements in or relating to armoured concrete structures.

ELECTRICAL.

26,348. W. Ohnesorge, Temple Bar, London.—Improvements in and relating to systems of connections for the operation of branch telephone stations and the like.

26,355. A. Hein, London.—Improvements in and connected with electrically-driven vacuum cleaning or dust removing apparatus.

26,460. J. F. Mason, London.—Improvements in or relating to trolleys of electric cars and the like.

26,461. J. Stratton and E. A. Claremont, London.—Improvements in joint boxes for the protection of joints of electric cables and the like.

26,510. W. J. Fahn and B. Jirotka, London.—Improved means for transforming direct electric currents.

26,601. O. Imray, London.—Improvements in automatic electric cutouts. (J. A. Hoffe, Cape Colony)

26,512. E. WILSON and W. H. WILSON, London.—Improvements in connection with electrostatic watt and watt-hour meters.

26,548. E. TOPHAM, Manchester.—Improvements in dynamo electric machines of “direct continuous current.”

26,629. C. DE KANDO, London.—Improvements in or relating to connections or two or more three-phase motors.

26,631. H. ANDREE, London.—Improvements in electro-magnetic motors with travelling fields.

26,662. H. C. BRAUN, London.—An improvement in electrical batteries.

26,688. S. G. BROWN, London.—Improvements in or relating to means for converting varying alternating electric current into similarly varying direct current.

26,689. O. S. BRAGSTAD, London.—Improvements in or relating to the distribution and supply of current in electric railway systems.

26,713. J. L. ROUTIN, London.—Improvements in controlling electric current distributing systems.

26,807. W. N. L. DAVIDSON, London.—Improvemenss in dynamo electric apparatus.

26,808. R. LUNDELL, London. Improvements relating to alternating current motors.

26,870. C. A. PARSONS and J. H. ARMSTRONG, London.—Improvements in and relating to dynamo electric machinery.

26,897. V. A. FYNN, London.—Improvements in single-phase commutator motors.

26,898. A. V. FYNN, London.—Improvements in or relating to single or polyphase alternate current motors and generators.

26,925. E. ROTHWELL, London.—Improvements relating to electric railways working on the surface contact system.

SHIPBUILDING, ETC.

26,338. G. F. VILLINGER, London.—Improvements in reversible propellers.

26,353. W. KEY, London.—Improvements in the ventilating of steam ships.

26,360. A. J. BOULT, London.—Improvements in or relating to propeller shaft thrust bearings. (Samuel S. Eveland, United States).

26,613. FLOWER AND CO. and E. W. FLOWER, London.—Improved transmitting mechanism applicable for changing the pitch angle of reversing screw-propellers and other purposes.

26,618. D. W. RANTINE, London.—Improvements in propellers.

26,721. A. W. PENNY, London.—Improvements in or relating to floating docks.

26,759 W. THOMSON, Baron KELVIN, and KELVIN AND J. WHITE, LTD., Glasgow.—An improved apparatus for adjusting the compass at sea without sights.

26,800. W. J. GREAVES, London.—Improvements in marine boilers.

26,802. H. H. LAKE, London.—Improvements in apparatus for controlling and steering submarine, submersible or similar boats. (Electric Boat Co. United States).

26,816. G. W. MAYTHAM, London. Improvements in the construction of ships.

MINING.

26,411. E. A. HAILWOOD, Morley.—Improvements in and relating to brushes for cleaning miners' safety lamps, bottles, or the like.

26,653. J. H. HOLLINGS, Sheffield.—Improvements in locking devices for securing colliery corves or wagons.

26,561. W. BEST, London.—Improvements in or relating to miners' safety lamps.

26,851. J. A. C. ROBINSON and E. MAKEPEACE, Sheffield.—Improvements in safety suspending or retaining apparatus for miners' pit cages, elevators and the like.

IRON AND STEEL—METALLURGICAL.

26,534. G. PATCHIN and W. G. RUMBOLD, Wimbledon.—Improvements in the method of obtaining lead and silver from ores or ore residues containing the lead either as sulphate or in a form capable of being converted into that salt and the silver in the form of silver chloride.

26,556. D. CAMPBELL, R. B. J. BINNIE, and W. REID, Glasgow.—Improvements in apparatus for washing and separating coal and other minerals

26,577. W. F. L. FRITH and C. J. GRIST, London.—Improvements in and relating to the treatment of metals such as steel and steel alloys and in the products obtained thereby.

26,578. W. F. L. FRITH and C. J. GRIST, London.—Improvements in and relating to the protection of joints, fastenings and other parts of covers of hermetically sealed receptacles in highy heated muffles or furnaces.

26,603. A. G. BLOXAM, London.—Improvements in tube rolling mills.

26,608. D. SINCLAIR, Liverpool —Improvements in moulding machines for use in foundries.

26,711. H. L. SULMAN, H. F. KIRKPATRICK-PICARD and J. BALLOT, London.—Improvements in or relating to the separation of minerals.

26,712. H. L. SULMAN, H. F. KIRKPATRICK PICARD and J. BALLOT, London. Improvements in or relating to ore concentration.

26,742. D. LEWIS and E. T. PRYTHERCH, Gorseinon.—Worm gear for an improved slow motion for turning rolls.

26,786. F. HERBERT, London.—Improvements in machinery for forming moulds for casting metal pipes.

26,301. YARROW AND CO. (BOLTON LTD., M. YARROW and W. R. HAWORTH, Keighley. Improved method of and means or forming moulds for casting pipes or mains.

26,344. E. A. CLAREMONT and J. STRATTON, London.—Improvements in the manufacture of sheet lead.

26,362. W. SELTNER, London. Improvements in or relating to jiggers for separating and grading materials.

26,471. H. R. ANGEL, London. Improvements in the treatment and reduction of complex sulphide ores.

26,472. H. R. ANGEL, London.—Improvements in the construction of a furnace for the treatment of sulphide and other ores.

26,475. J. ELSNER, London.—Improvements in coal washing chambers.

26,482. E. L. E. CHENOT, London.—An improved portable forge.

26,529. S. COWPER-COLES, London. Improvements in zinc alloys.

26,530. S. COWPER-COLES, London. Improved process for the manufacture of alloys.

26,709. H. BAKER, London.—Improved process for the treatment of complex sulphide ores.

26,813. E. A. ASHCROFT, London.—Improvements in or relating to the electrolysis of metallic compounds or ores.

26,902. S. O. COWPER-COLES, London.—Improvements in the electrolytic production of metallic sheets, tubes, wire, strip or the like.

ABRIDGED SPECIFICATIONS.

H. T. Hincks, Brantwood, Book Lane, Chester.—19,001.—Relates to slide rules.—Circular logarithmic multiplying and dividing rules, with scales designed for calculating the Ohm's law relations between the dimensions of electric conductors, their specific conductivity, and the current and voltage for which they are to be used, are shown in figs. 4 and 5. Stationary upon the base-plate are scales *b*, *c* of voltage and "conductivity constant" respectively. Between them is a rotatable disc, covering the scale *c* except where a gap *f* allows of setting, and itself carrying scales *g*, *h* respectively of amperes and area of conductor in thousandths of a square inch. The quantity set upon the "conductivity constant" scale is the area of conductor of the particular material to be used which will have a resistance of one Ohm per thousand yards, with an increase 5·7 per cent. over the theoretical value for variation, bad joints and sag; and has different values for continuous, single-phase, or polyphase currents. When the arrow *d* upon the movable outermost or length of conductor scale *e* is set to the proper constant, for any position of the disc *g* *h* corresponding values of the current, voltage, and length of conductor will be on the same radial line, and any one may be determined if the other two are known. Fig. 5 shows the scales mounted in a casing *k* of watch form, and in other modifications there are means for rotating the rings. The apparatus can be used for calculations with regard to the flow of liquids in pipes.

FIG. 5.

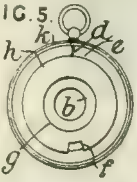
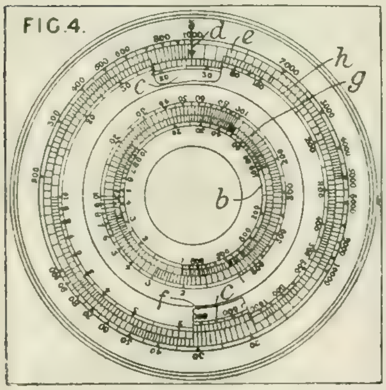


FIG. 4.



Vickers, Sons and Maxim, and L. Silverman, 32, Victoria Street, Westminster, London.—19,403.—A lubricator for motor cars, steam or oil engines, etc., consists of a vessel A², fig. 3, containing a number of superimposed rollers A, from the top one of which oil is removed by a number of flexible scrapers C mounted on tubes B leading to the parts to be lubricated. The rollers are hollow, and frictionally engage each other at the ends, which are of slightly increased diameter. The top roller is driven by the worm gearing a^2, a^3, from any moving part. Spiral springs connect the spindles of the top and bottom rollers to ensure sufficient contact. The scrapers C consists of steel wire flattened at the upper ends. The mouths of the pipes B may serve as scrapers. The vessel has a transparent window a^9, and may also have a gauge glass a^{10}, the cover of which a^{11} may serve as the filling aperture. The upper part of the vessel may be hinged to the lower part to permit inspection of the interior. Fig. 9 shows a modification in which the rollers are geared together by means of toothed wheels. The scraper C has a bent portion *c* lying above the mouth of the tube B, and oil collecting at the bent portion falls drop by drop, forming a sight feed viewed through the opening a^9. The scrapers C are detachably mounted in notches in the bar a^{16}, which is retained in position by the cover of the apparatus. For lubricating cylinders, a chamber [illegible] is provided in the pipe B, so that the variation of pressure will not affect the flow of lubricant. Instead of a series of superimposed rollers, an endless band of steel, etc., passing around a pair of rollers may be used. Fig. 11 shows an arrangement in which the scraper C is made adjustable in size by forming it in two or more parts, which can be moved into or out of contact with the roller A. The scrapers slide in notches in the bar a^{16}, and are held in position by spring plungers a^{17} engaging recesses a^{20} in the scrapers. The movement is limited by finger pieces a^{18} and lips a^{21}.

FIG. 9.

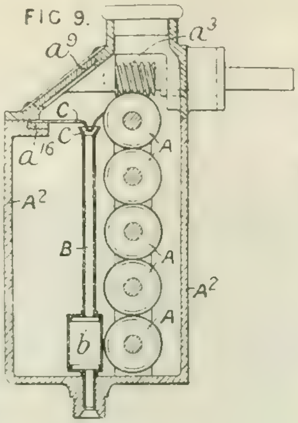


FIG. 3.

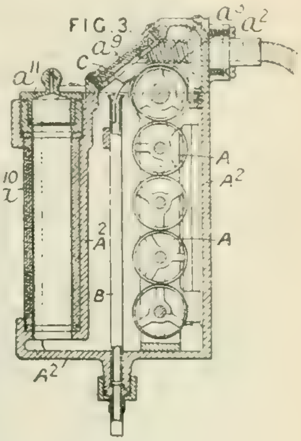
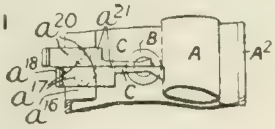


FIG. 11



NEW PUBLICATIONS.

"THE YEAR BOOK OF THE SCIENTIFIC AND LEARNED SOCIETIES OF GREAT BRITAIN AND IRELAND."

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The value of this most useful handbook increases every year. We have repeatedly submitted it to practical tests and the results have always been satisfactory. Those of our readers engaged in scientific research will find the lists of papers read before the various technical societies quite indispensable. The work is admirably arranged for reference.

"THE WAYS OF OUR RAILWAYS."

By Charles H. Grinling. Ward, Lock and Co., Ltd. 10s. 6d.

In no sense of the word can this volume be regarded as a technical treatise; the author's aim has been to furnish the general reader with a description in ordinary language of the machinery and methods by which the railways of the United Kingdom are worked at the present day—a subject of no small interest to the travelling public. Only the most approved practice, we are informed, is dealt with in this volume, and, says Mr. Grinling, "I have thought it best to divide my subject with reference to the principal departments of railway activity, and not under the titles of leading companies. Methods, of course, vary on different lines, and whenever it has seemed an open question as to which company had adopted the best practice, I have mentioned alternatives. In those departments in which some of the companies are notably ahead of the others, I have drawn my examples mainly, and sometimes solely, from the superior exponents of those branches of the art of railroading." After reading this candid admission, and also his assurance later on of impartiality, we were rather surprised to find on examining the illustrations that the Midland Railway, one of our most progressive companies, receives comparatively scant attention. The fact is sufficiently evidenced by the undermentioned figures relating to the number of illustrations allotted to some of the leading companies: London and North-Western, 56; Great Northern, 20; Great Western, 20; Midland, 3. In the chapter on docks and steamships considerable attention is devoted to the new graving dock at Southampton, a feature which tends to prove that the book is well up-to-date. But the extensive harbour works of the Midland Railway at Heysham are dismissed with a description of about nine lines. The following brief synopsis of its contents indicates the general scope of the book; the constitution of the companies, the service of the staff, the laying down of the lines, the mechanism of the motive power, electrical equipment, control of the trains, passenger department, the commissariat, work of the wagons, collection and delivery, docks and steamers, the legal department, Christmas traffic, and the parcels department. Altogether the volume is a very entertaining compilation, and in some respects, very amusing. It is admirably got up, the printing, paper, and engravings being of a first-class order.

CATALOGUES, ETC.

A reprint has been issued by Mr. Percy Pitman of Bosbury, Ledbury, describing his tangential water wheels with improved adjustable nozzles of rectangular section.

The British Prometheus Company, Ltd., Kingston-on-Thames, forward their 1905–6 catalogue describing and fully illustrating the "Promotheus" electric heating apparatus.

Drakes, Ltd., Gas and Carbonising Engineers, Ironfounders and Contractors, Halifax and Leeds.—All the advantages that can be obtained from good half-tone work the firm have taken in preparing the catalogue and pamphlet before us. The latter is devoted to views of the works at Halifax and Leeds, and a highly artistic effect has been secured by printing each view in black, in a pale green frame. The catalogue fully illustrates the many aspects of gas making plant. We observe that the number of furnaces erected by the firm has been steadily on the increase, and that in nine years it has amounted to 912. A large number of illustrations show inclined retort installations complete and also during course of construction, and we are advised that the firm undertake the erection of benches, furnaces, and settings complete with furnace and retort fittings, structural ironwork, stages, staircases and platforms, coal hoppers, measuring chambers and shoots, coal breaking, elevating and conveying plant, and hot coke handling, screening and storing plants. A useful section is devoted to furnace frames and doors, and the work also includes a quantity of information on the subject of coal and coke handling machinery, for the manufacture of which special plant has been laid down.

The "Lucal" Light and Heating Company, Ltd. of Glasgow, forward a report of a recent test made on a marine type boiler fitted with their "Lucal" burners. Messrs. Flannery, Baggallay and Johnson report that the boiler in question was situated at the Clyde Trust power station at Princes Dock, Glasgow, had two 38-in. furnaces, fitted with three "Lucal" burners to each furnace. The average evaporation of water from and at 212 deg. F. was 14 lb. of water per lb. of oil. The burners during the six hours, test appeared to burn steadily, and when properly adjusted gave a clear bright flame. As, however, three other boilers burning coal were working on the same chimney, they were unable to watch this point as closely as might otherwise have been possible. In order to approximate to the percentage of steam evaporated to the steam used by the burners, a burner of similar type was tested. A pipe coil placed in the flame was added, to generate its own steam, the water being supplied to this coil at 60 lb. pressure. The test of this burner showed that 4½ lb. of water were consumed for generating steam to burn 23½ lb. of oil, equivalent to ·1915 lb. of water per lb. of oil burnt. From this it would appear that the amount of steam necessary for use in the burner would amount to 1·74 per cent. of the water evaporate in the boiler.

BOOKS RECEIVED.

"Alternating Currents." Their theory, generation, and transformation By Alfred Hay, D.Sc., M.I.E.E. Harper and Bros. 6s. net.

"Practical Coal Mining" By G. L. Kerr, M.I.Mech.E. (Charles Griffin and Co., Ltd. 12s. 6d.

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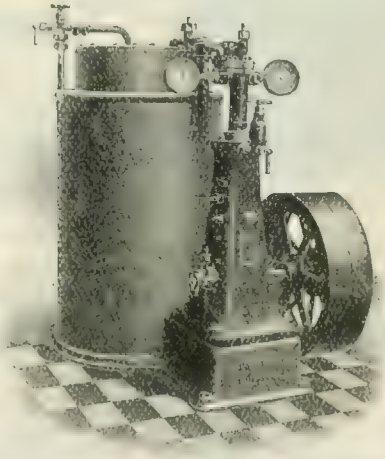

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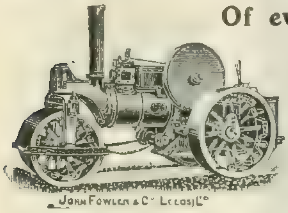
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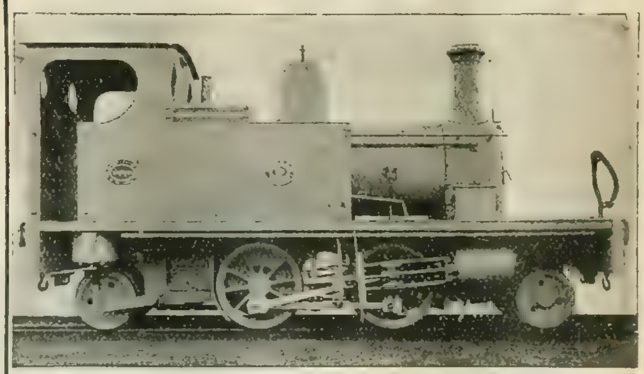

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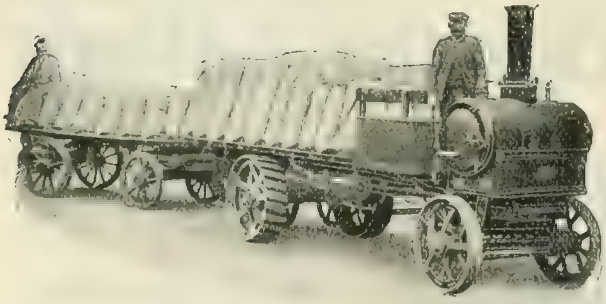

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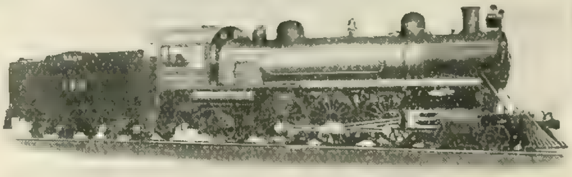

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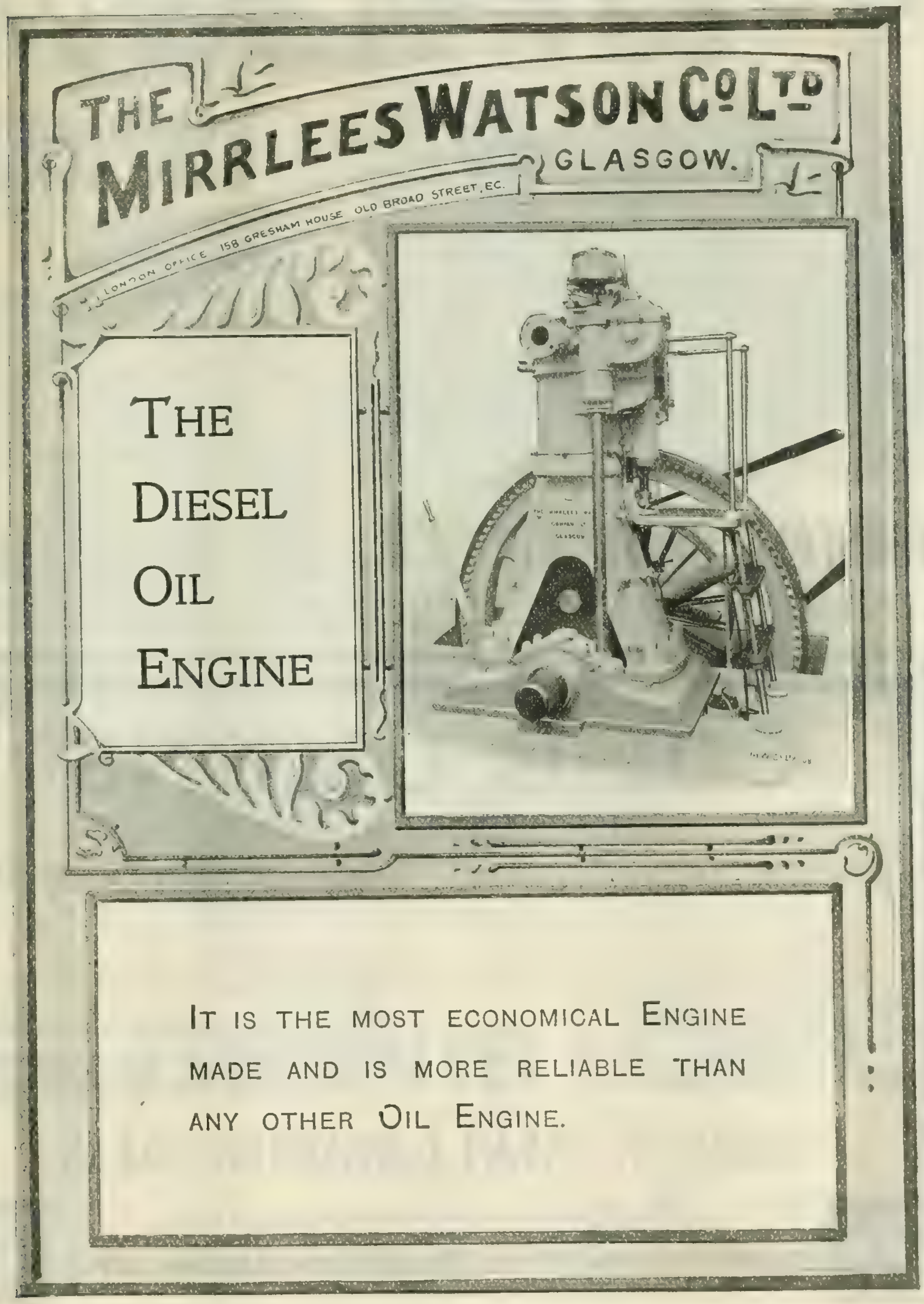

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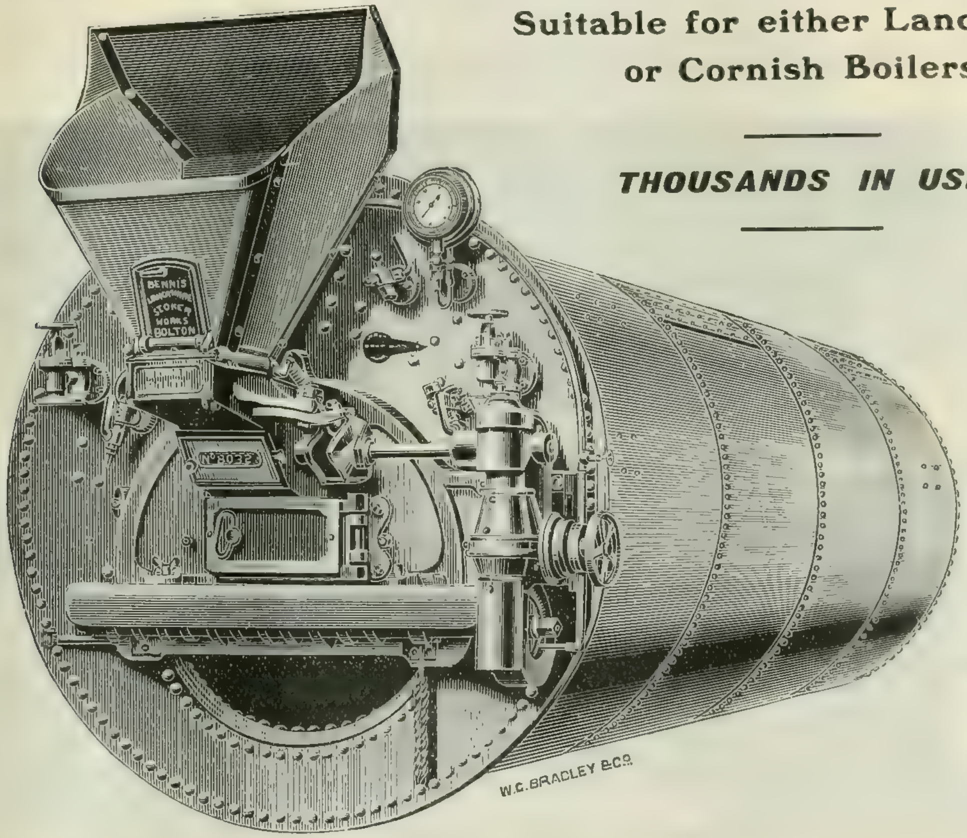
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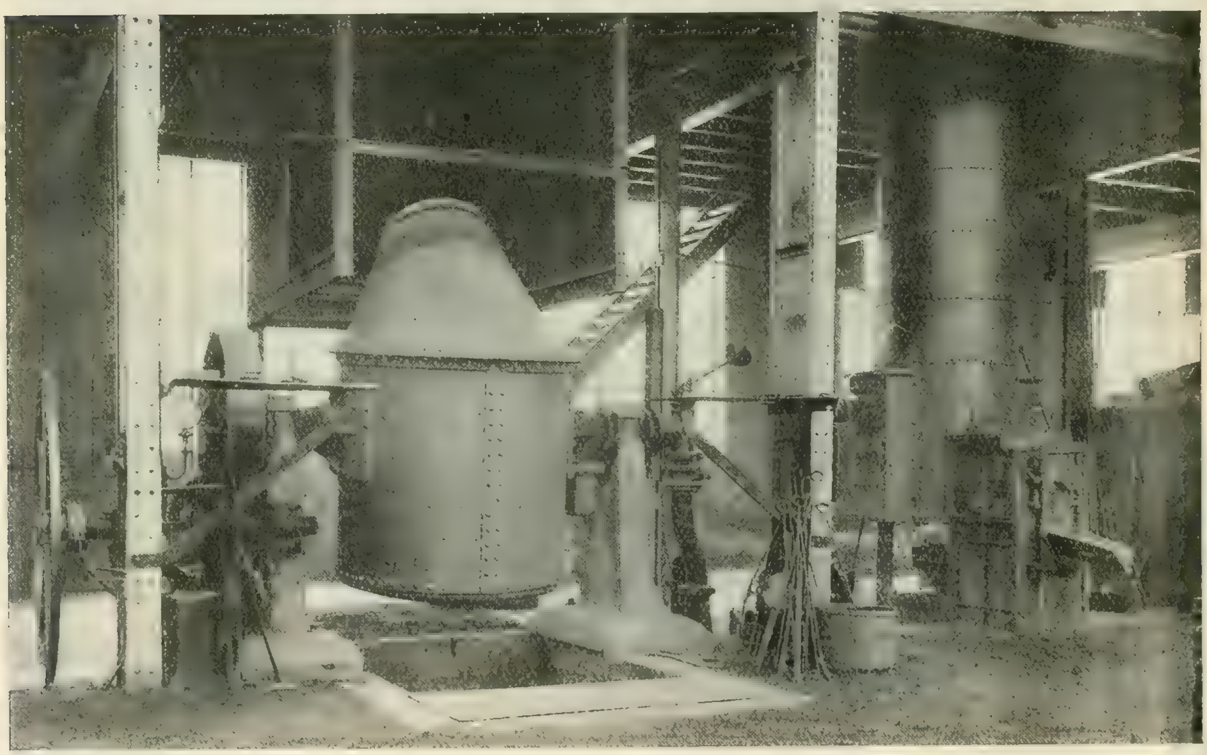

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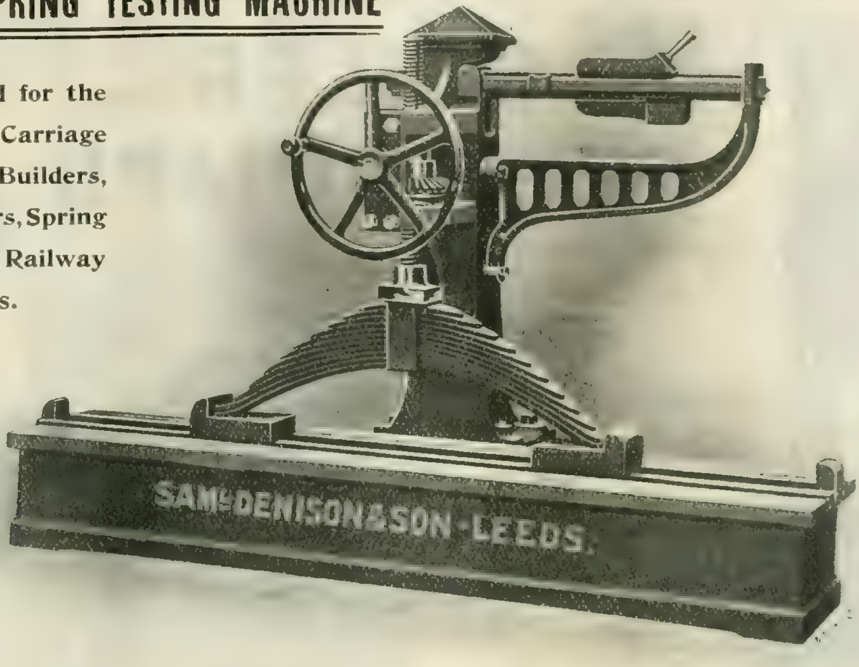

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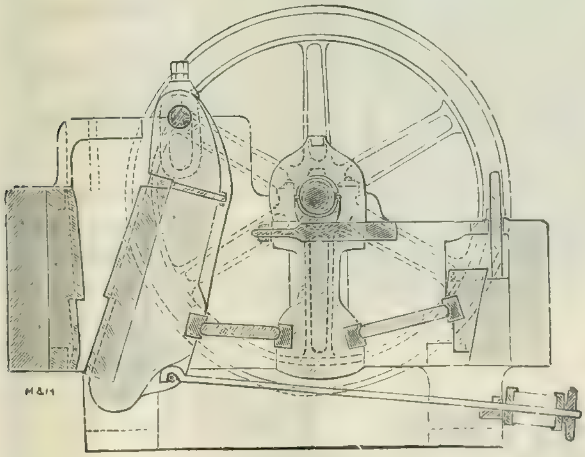

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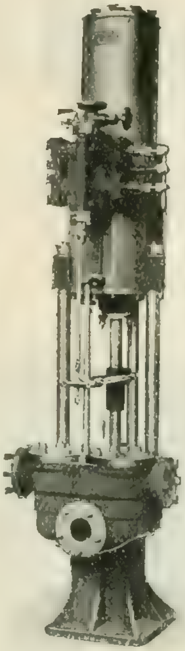

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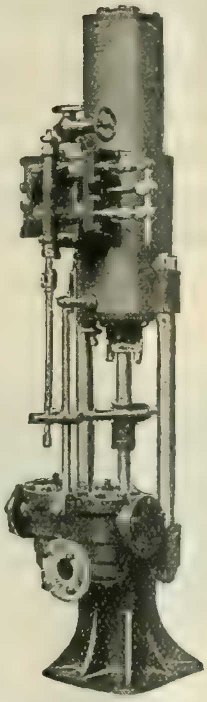

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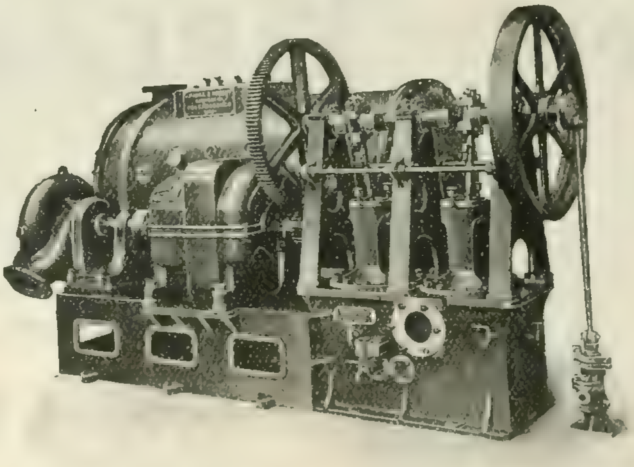

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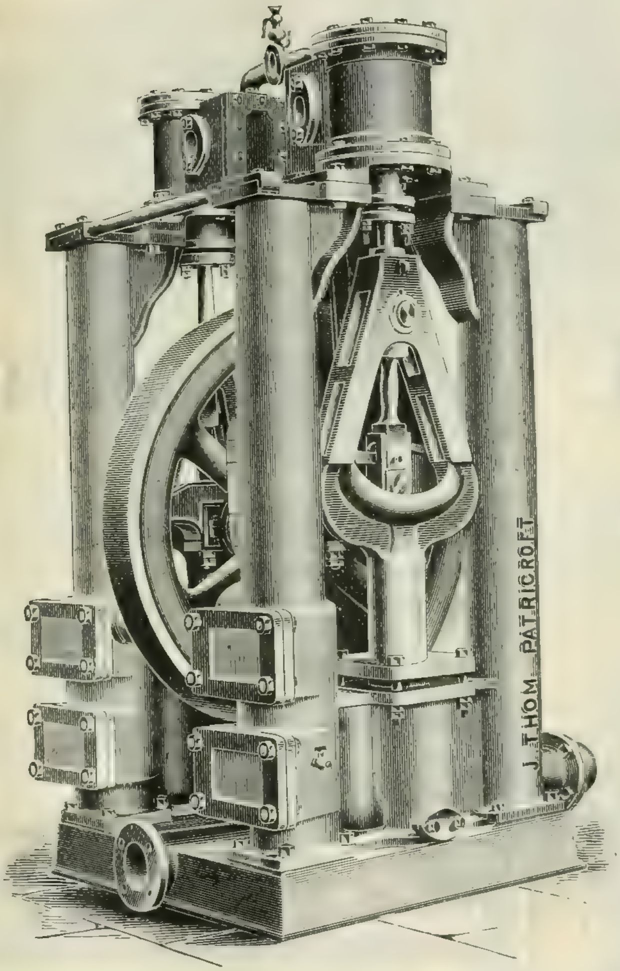
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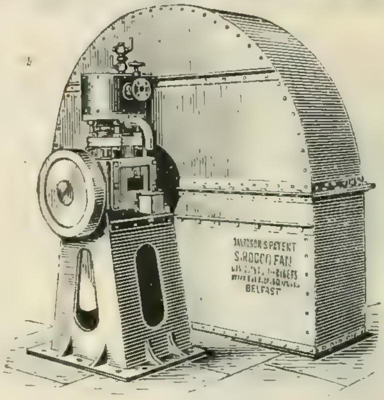

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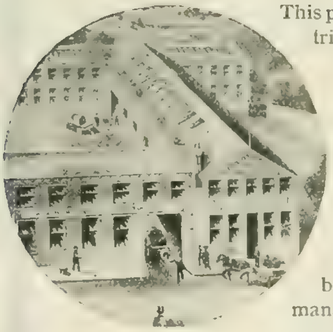

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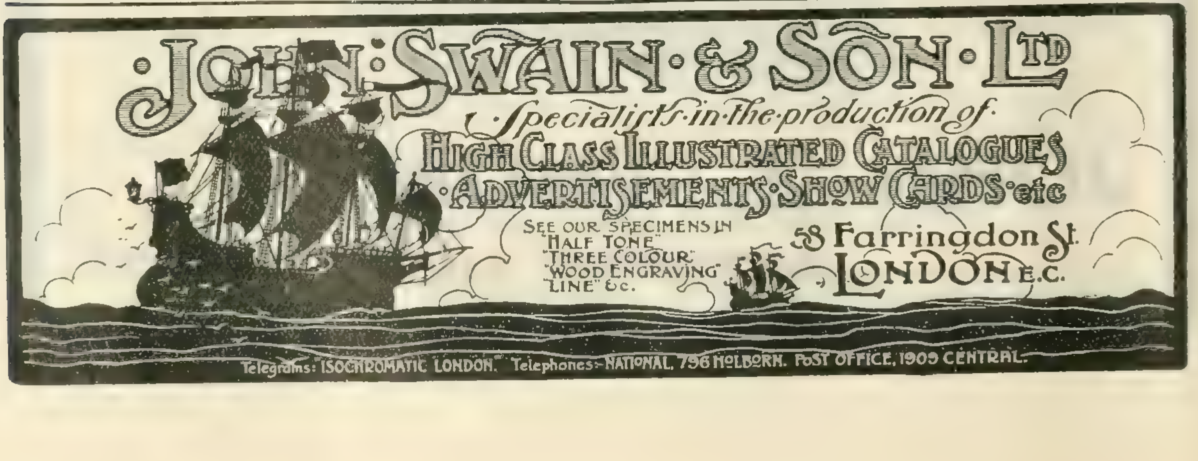

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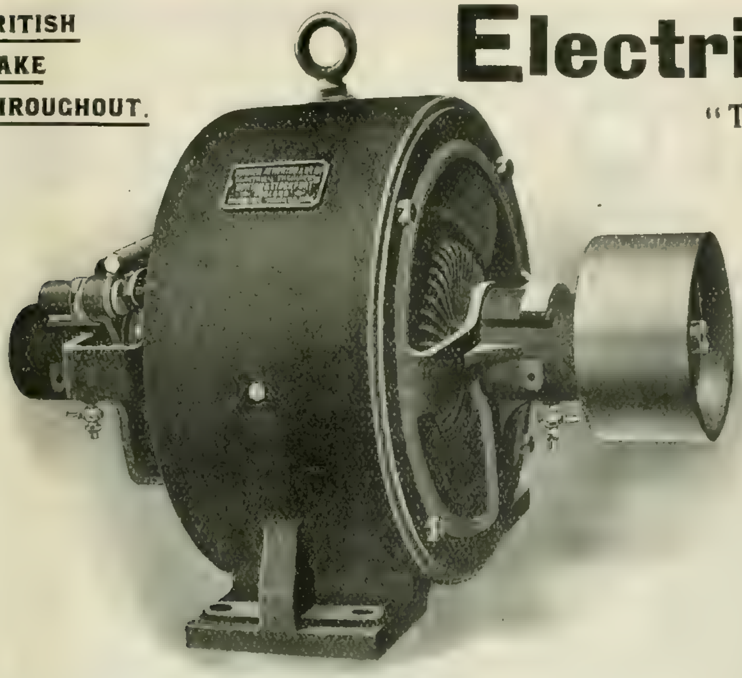

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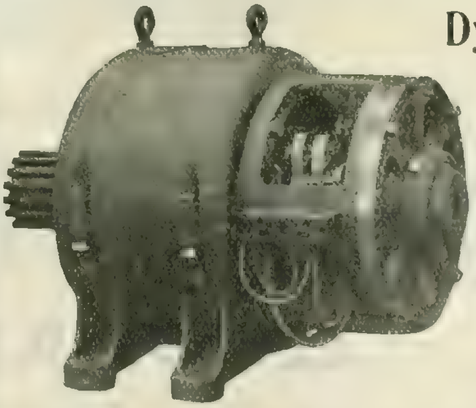

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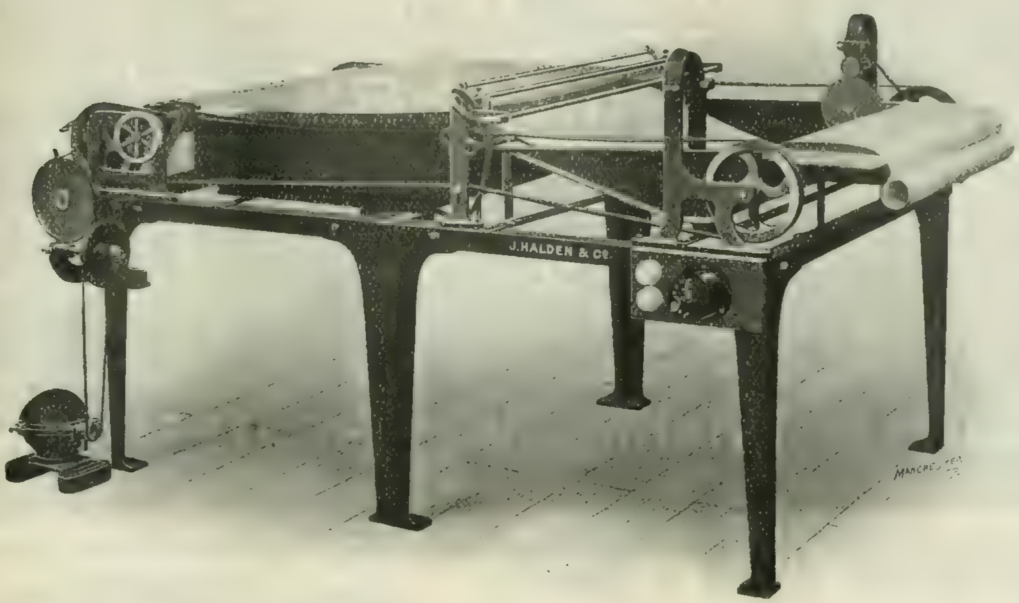

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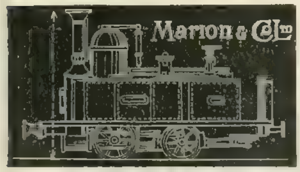

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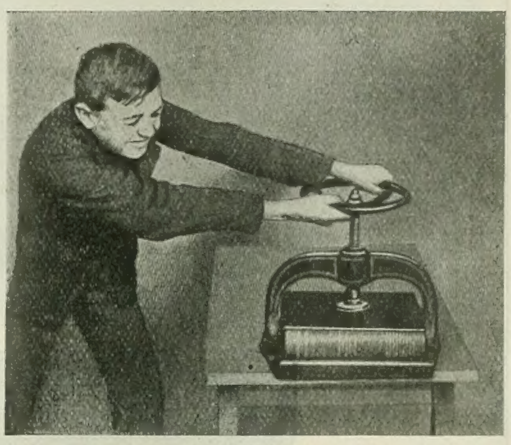

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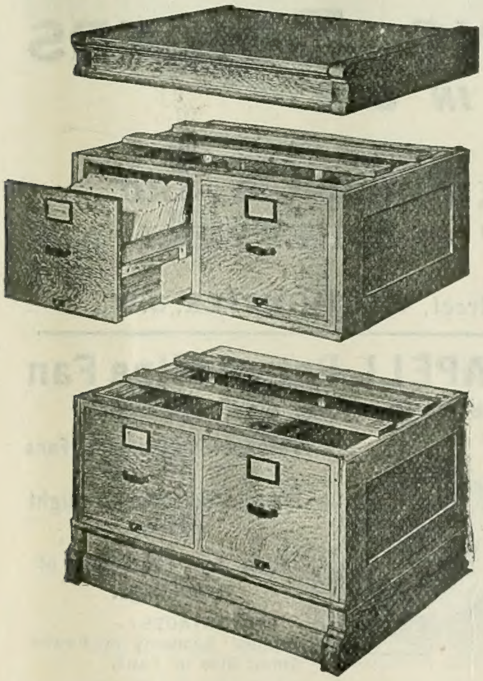

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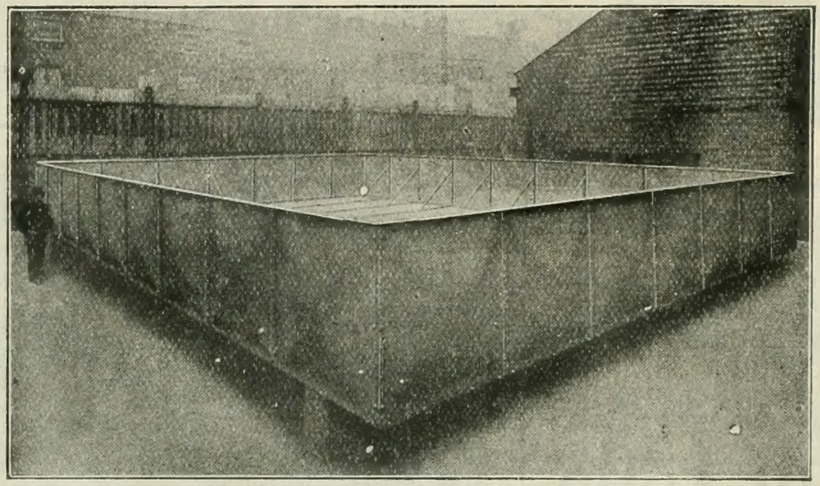

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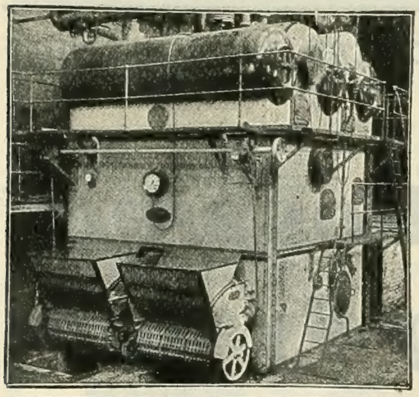

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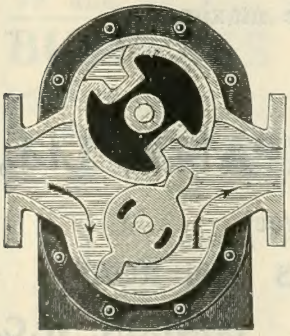

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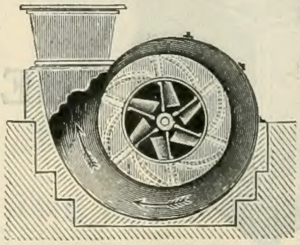

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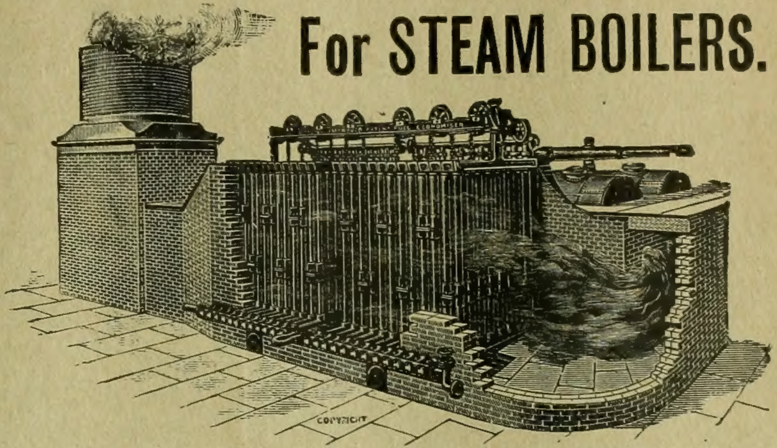

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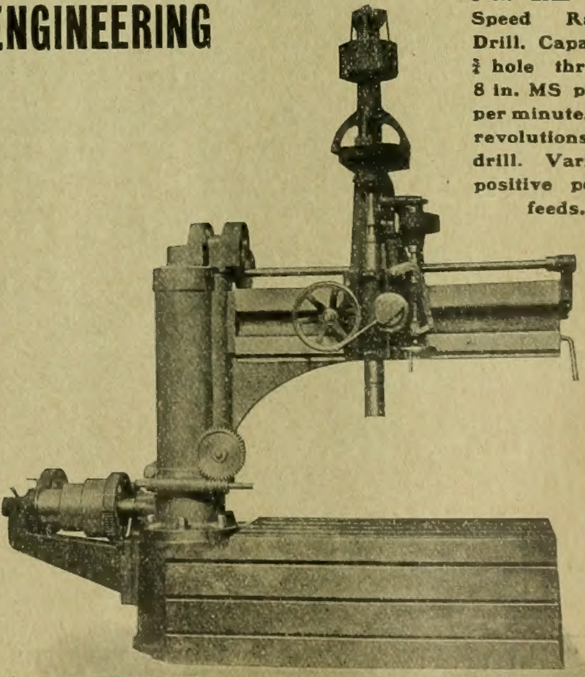

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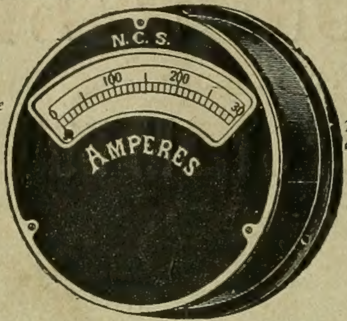

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